International Journal of Engineering Research & Management Technology
ISSN: 2348-4039
November-December-2016 Volume-3, Issue-6
Email: editor@ijermt.org www.ijermt.org

LIMNO CHEMISTRY OF DRINKING WATER (SURFACE WATER) OF SRI GANGANAGAR DISTRICT RAJASTHAN - INDIA

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Abstract :-

The present study describes the surface water quality of Sri Ganganagar districts. The result of this study efforts were made to evaluate the water quality of drinking water. The Water samples were analyzed for pH, hardness, and dissolved O, which are essential parameters for human and animalconsumption. The average value of Hardness is 150 mg/l which indicates that itis slightly hard water. The value of Do is 10.8 which represent good, concentration in water for respiration needed by living organisms. The finding of this study are expected to convey essential information on the safe use of water from tube well, hand pump, tanks

Keyword - Hardness, pH, Water, Agriculture, D.O

Introduction:-

Water is one of the most abundant substances on the earth. It is essential for survival of any plant and animal, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities. Water, the precious gift of nature for human beings, is being polluted day-by-day with increasing urbanization. Although three-fourth of the earth is being surrounded by water, a little portion of it can be used for drinking purpose. In developing countries like India, most of the diseases such as gastroenteritis, diarrhea, dysentery, cholera, enteric fever etc prevail due to unsafe drinking water. Only 12% of people get good drinking water. The chemistry of natural surface waters is complex, and depends on the equilibrium reached with the normal physical, chemical and biological characteristics of the surrounding environment. Thus, there can never be a normal surface water quality; every natural water will have a different composition (Alabaster and Lloyd, 1980). Characteristics

required for drinking water are specific. It is, therefore, very important to know the quality of drinking water so as to know the possible effects of this water on human beings and animals. The present investigation is thus a small contribution to understand the quality status of drinking water of different villages of Sri Ganganagar district of northern Rajasthan.

Material And Methods:-

Water Samples Collection:-

The water samples were collected from different sites of different villages/towns in Ganganagar district and Sri Ganganagar city. For sample collection Ganganagar district was divided in six different zones namely zone A, B, C, D, E and F. The Zone A consists of 11 sample points, zone-C consists of 12 sample points and zone-B, zone-D, zone-E and zone-F each consists of 10 sampling points. The selection of sample sites was based on population density, environmental conditions and nearness of domestic pollution. Total 63 samples were collected from supply water (Surface water). The samples were collected from May, 2015 to December, 2015.

Methodology for water quality analysis:-

Water samples were collected in one liter polythene sampling bottles from different sites of Sri Ganganagar district and analyzed according to strict sampling protocols described by Gale and Robin (1989). Analysis of pH, CO_2 and dissolved oxygen were conducted on site with portable kit. The samples were transported in ice cooler. Chemical analysis of the water samples were conducted using standard methods recommended by APHA (1998), Trivedi and Goel (1984) and Khanna & Bhutani (2008). The methodology followed in the investigation is given below in brief.

Result and Discussion:-

The result obtained from physico-chemical analysis of 63 surface water samples of Sri Ganganagar district are given in table 1 to 6. Total eleven physico-chemical parameters such as pH, freeCO_2, dissolved oxygen; chloride, Total hardness, calcium hardness, magnesium hardness, total alkalinity, sulphate, nitrate and

total dissolved solids were analyzed. These results were compared with WHO (1963), BIS (1991) and ICMR (1975) drinking water standard.

pH:-

All the biochemical reactions are sensitive to variation in pH. For most of the reactions as well as for human beings, pH seven of drinking water is considered as the best and ideal. In present investigation the surface water pH was more or less similar in all sample points. The surface water pH varied between 7.00 (in AS_9) to 8.10 (in DS_5) with an average value of 7.54. The pH for all the samples was ranged within permissible limits of WHO & BIS.

Free Carbon dioxide:-

The carbon dioxide content of water depends upon the temperature depth, range of respiration, decomposition of organic matter, chemical nature of the bottom and geographical feature of the terrain surround in the water body.The high range of CO_2 is present in polluted water. In present study free carbon dioxide was ranged from 0.0 mg/l. to 13.2 mg/l (in AS_5 & ES_1) with an average 3.19 mg/l. The free CO_2 was absent in about 2/3 surface water sampling stations. The free CO_2 of were in the permissible limits.

Dissolved oxygen (DO):-

The Oxygen is the one of most important factor in any aquatic ecosystem. The main sources of dissolved oxygen are from the atmosphere and the photosynthesis. There is no standard for dissolved oxygen for water quality assessment. Low D.O. gives bad odour to water due to anaerobic decomposition of organic wastes. The D.O. level in natural waters depends upon physical, chemical and biological activities prevailing in the water bodies. In the present study the dissolved oxygen in surface water varied from 2.4 mg/l (in AS_{10}) to 8 mg/l (in ES_3) with an average value of 4.27 mg/l. In the present study the dissolved oxygen in most of the water samples were reported above the limiting value of 3 mg/l.

Chloride:-

High chloride content can cause high blood pressure in people. Chloride in excess (<250 mg/l) imparts a salty taste to water and people who are not accustomed to high chloride may be subjected to laxative effect. High Chloride concentration is also an indicator of large amount of organic matter. In the present study the chloride concentration of surface water varied between 2.8 mg/l (in AS_1& AS_2) to 27.6 mg/l (in CS_{11}) with an average 10.39 mg/l. Chloride concentration was generally below the permissible limit (250 mg/l) for all samples.

Total Hardness:-

Hardness is a measure of the ability of water to cause precipitation of insoluble calcium and magnesium salts of higher fatty acids from soap solutions. The principal hardness causing cations are calcium, magnesium bicarbonate, carbonate, chloride

and sulphates. . Hardness below 300 mg/l is considered potable but beyond this limits cause gastro-intestinal irritation (ICMR 1975). Normal water hardness does not pose any direct health problems. Jain et.al 1998 reported that high concentration of hardness (150 to 300 mg/l and above) May cause kidney problems.Normal water hardness does not pose any direct health problems. Jain et.al 1998 reported that high concentration of hardness (150 to 300 mg/l and above) May cause kidney problems.In the present study the hardness was varied from 28 mg/l (in BS_4) to 162 mg/l. (in DS_5) with an average value 82.76 mg/l.

Calcium and magnesium:-

The observed value of calcium for surface water was ranged from 2.5 mg/l (in ES_3) to 61.4 mg/l (in AS_{10}) with an average value of 26.21 mg/l. The observed value of calcium was within the permissible limits. A small concentration of calcium is reducing corrosion in water pipes. The observed magnesium value was ranged from 2.4 mg/l (in BS_4) to 36.3 mg/l (in DS_5) with an average value of 13.6 mg/l. Observed value of magnesium in present study was within the permissible limit. Magnesium hardness particularly associated with sulphate ion has laxative effect on person unaccustomed to it (Khursid, 1988).

Total Alkalinity :-

Alkalinity in itself is not harmful to human being; still the water samples with less than 100 mg/l are desirable for domestic use. The high alkalinity imparts an unpleasant taste. The alkalinity of water is its capacity to

neutralize a strong acid and is characterized by the presence of all hydroxyl ions capable of combining with hydrogen ion. In the present investigations the alkalinity was varied from 4 mg/l (in AS_9) to 30mg/l (in AS_2) with an average value of 15.93 mg/l. The observed values of alkalinity was within the permissible range of WHO.

Sulphate:-

Sulphate ion does not affect the taste of water if present in low concentration. In present investigation the sulphate ion concentration was ranged from 0.04 mg/l (in CS_{11}) to 7.4 mg/l (in BS_3) with an average value of 3.15 mg/l. The observed value of sulphate in present study was found within the permissible limits of WHO (1993) (250 mg/l). Bouwer (1978) report that sulphate concentrations in drinking water should not exceed 250 mg/l because the water will have a bitter taste and can produce laxative effects at higher levels.

Nitrate:-

Nitrate is the most important nutrients in an ecosystem. Generally water bodies polluted by organic matter exhibit higher values of nitrate. Nitrate is an important parameter in water quality assessment. Generally water bodies polluted by organic matter exhibit higher values of nitrate. In the present study nitrate values was ranged from 0.4 mg/l (in BS_1) to 4.6 mg/l (in CS_8) with an average value of 1.87 mg/l. In the present study water samples showed low concentration of nitrate well below permissible levels of WHO (45 mg/l).

Total dissolved solids (TDS) :-

TDS is important parameter in drinking water. This includes various kinds of minerals present in the water. Organic substance present in the polluted water may also contribute to the TDS. However, dissolved solids do not conation any gas and colloids. In natural waters, TDS are composed of mainly of carbonates, bicarbonates, chlorides, sulphates, phosphates and nitrate of calcium, magnesium, sodium, potassium and manganese (Mahandnda, 2010). Dissolved solids give a particular taste to the water at high concentration and also reduce its palatability. High concentration of dissolved solids above 3000 mg/l may also produce distress in cattle and live stock. In industries, the use of water with high amount of dissolved solids may lead to the sealing in boilers, corrosion and degraded quantity of the product. In the present investigation the value of TDS was observed

between 100 mg/l (in BS_5) to 1884 mg/l (in CS_4) with an average value of 748 mg/l. The TDS value was within the maximum permissible limit 2000 mg/l of BIS.

Conclusions:- The present study was undertaken with an aim to analyze certain physico-chemical parameters in the ground water and surface water samples in different villages of Sri Ganganagar district. The parameters analyzed in present study show that the water is soft water but all the parameters are within the permissible limits for drinking water recommended by WHO, BIS and ICMR. This study would help the water quality monitoring and regulation in order to improve the quality of drinking water with better sustainable management.

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Table-1 : Physico-chemical parameters of surface water of Zone-A

Sr. No.	Sampling Stations	Parameters										
		pH	CO2	DO	Cl	T.H.	Ca	Mg	Total Alkalinity	SO4	NO3	TDS
1	AS1	7.55	Ab	2.8	2.8	36	7.8	6.8	6	2.3	1.4	160
2	AS2	7.3	12	3.2	2.8	112	58.7	12.9	30	0.3	0.7	180
3	AS3	7.44	1.5	4.4	6.2	62	28.4	8.1	18	3.3	1.7	880
4	AS4	7.95	4.4	4.9	17	40	8.9	7.5	10	1.5	0.8	110
5	AS5	7.95	13.2	2.8	16.3	110	27	20.1	24	4.4	1.6	240
6	AS6	7.42	1.4	4.6	8.3	74	28.4	11	20	3.5	1.5	770
7	AS7	7.5	8.8	3.8	9.9	160	54.6	25.6	14	1.4	1.2	810
8	AS8	8.05	8.8	3.8	22	100	54.6	11	12	2.7	2.3	1300
9	AS9	7	4.4	4.6	17.7	60	23	8.9	4	2.6	1.8	1240
10	AS10	8.05	3.2	2.4	9.3	80	61.4	4.5	16	3.1	1.1	240
11	AS11	7.05	8.8	2.7	26.9	60	23.8	8.7	14	0.7	0.8	390

Table-2 : Physico-chemical parameters of surface water of Zone-B

Sr. No.	Sampling Stations	Parameters										
		pH	CO2	DO	Cl	T.H.	Ca	Mg	Total Alkalinity	SO4	NO3	TDS
1	BS1	7.38	Ab	4.7	8.6	74	21.6	12.7	15	3.2	0.4	460
2	BS2	7.69	Ab	5.2	16.3	70	29.4	9.8	12	4.1	3.2	380
3	BS3	7.74	2.2	3.6	7.1	34	9.4	5.9	20	7.4	3.8	140
4	BS4	7.73	13.2	4.8	4.2	28	17.8	2.4	14	3.8	1.7	120

5	BS5	7.78	8.8	4.4	3.5	120	33.6	20.9	10	2.2	1.6	100
6	BS6	7.12	3.6	3.2	6.3	82	20.4	14.9	18	3.3	1	186
7	BS7	7.23	3.8	4.1	3.7	74	31.6	10.3	13	1.8	2.7	270
8	BS8	7.88	8.8	2.5	9.9	40	27.6	3.7	6	1.6	2.4	240
9	BS9	7.04	6.6	2.5	8.4	84	34.1	12.1	14	2.5	0.8	1200
10	BS10	7.93	Ab	4.6	14.2	50	26.0	5.8	12	3.1	2.8	1610

Table-3 : Physico-chemical parameters of surface water of Zone-C

Sr. No.	Sampling Stations	Parameters										
		pH	CO2	DO	Cl	T.H.	Ca	Mg	Total Alkalinity	SO4	NO3	TDS
1	CS1	7.46	1.6	4.5	6.3	116	26.4	21.7	14	3.2	2.6	660
2	CS2	7.22	3.4	4.8	8.3	108	32.2	18.4	12	3.1	2.4	884
3	CS3	7.06	Ab	3.6	9.2	128	30.4	23.7	16	4.2	1.8	1680
4	CS4	7.64	3.2	4.4	12.8	98	24.6	17.8	10	4.6	2.0	1884
5	CS5	7.08	2.8	4.8	5.6	140	15.1	30.3	10	2.8	1.6	1164
6	CS6	7.6	1.3	5.2	8.2	92	22.6	16.8	14	3.2	0.8	1536
7	CS7	7.18	1.2	4.6	12.4	88	18.4	16.9	12	0.1	1.6	960
8	CS8	7.26	Ab	4.6	3.5	106	12.6	22.6	12	3.4	4.6	1086
9	CS9	7.24	0.8	3.8	8.4	118	36.2	19.8	12	2.4	2.2	1160
10	CS10	7.40	2.4	4.2	12.8	96	24	17.4	18	4.1	1.8	1030
11	CS11	7.72	Ab	3.8	27.6	140	28.5	27	16	0.04	2.3	1588
12	CS12	7.46	1.8	4.8	18.4	102	30.6	17.3	14	3.8	1.2	1208

Table-4 : Physico-chemical parameters of surface water of Zone-D

Sr. No.	Sampling Stations	Parameters										
		pH	CO2	DO	Cl	T.H.	Ca	Mg	Total Alkalinity	SO4	NO3	TDS
1	DS1	7.64	1.2	4.2	12.1	74	24.0	12.1	18	3.2	1.8	680
2	DS2	8.00	Ab	3.6	14.2	50	36.5	3.2	24	1.6	1.2	140
3	DS3	7.2	3.2	3.0	7.1	60	23.4	8.8	20	3.4	1.8	120
4	DS4	7.8	2.4	4.6	16.4	68	18.6	12	18	3.8	0.8	940
5	DS5	8.10	Ab	2.5	7.8	162	12.6	36.3	18	2.8	1.6	1400
6	DS6	7.80	1.4	4.8	8.8	82	24.5	13.9	20	4.2	2.4	880
7	DS7	7.26	Ab	5.2	7.1	120	29.4	22	10	3.2	2.1	740
8	DS8	7.82	Ab	6.8	5.6	80	13.3	16.2	20	2.6	2.4	340
9	DS9	8.00	Ab	3.6	8.3	128	23.5	25.3	10	6.2	3.1	820
10	DS10	7.66	Ab	6.0	6.4	96	29.4	16.1	24	5.4	2.6	1400

Table-5 : Physico-chemical parameters of surface water of Zone-E

Sr. No.	Sampling Stations	Parameters										
		pH	CO2	DO	Cl	T.H.	Ca	Mg	Total Alkalinity	SO4	NO3	TDS
1	ES1	7.24	3.6	4.8	9.5	66	22.8	10.4	20	3.3	1.8	620
2	ES2	7.40	2.7	5.2	12.1	68	18.6	12	22	4.1	2.6	840
3	ES3	7.74	Ab	8.0	14.2	46	2.5	10.5	18	4.1	2.4	220
4	ES4	7.80	2.8	3.8	14.2	60	24.5	8.6	26	1.6	1.4	140
5	ES5	7.12	7.6	4.6	17.7	40	17.8	5.3	12	4.3	0.6	110
6	ES6	7.26	Ab	4.7	10.4	56	18.3	9.1	18	3.4	0.8	340
7	ES7	7.48	0.6	4.5	11.3	62	21.4	9.8	13	1.5	2.0	670
8	ES8	7.62	1.8	5.3	12.4	76	20.8	13.4	20	5.1	1.8	490
9	ES9	7.42	4.3	5.4	11.4	74	26.3	11.5	21	3.5	2.4	990
10	ES10	7.85	3.2	3.4	12.2	80	31.5	11.7	22	2.0	1.7	1120

Table-6 : Physico-chemical parameters of surface water of Zone-F

Sr. No.	Sampling Stations	Parameters										
		pH	CO2	DO	Cl	T.H.	Ca	Mg	Total Alkalinity	SO4	NO3	TDS
1	FS1	7.60	8.8	2.8	4.2	80	47.2	7.9	14	4.2	1.8	280
2	FS2	7.42	4.2	4.4	6.4	86	26.4	14.4	16	4.4	3.1	780
3	FS3	7.7	2.6	5.3	9.5	72	18.0	13.1	18	4.1	1.8	990
4	FS4	7.55	3.6	3.8	11.3	60	20.4	9.6	12	2.8	2.8	1096
5	FS5	7.80	2.4	4.8	4.5	86	18.0	16.5	20	4.5	1.2	1400
6	FS6	7.20	Ab	4.7	9.6	64	22.2	10.1	18	4.1	0.8	836
7	FS7	7.33	4.4	4.6	7.1	100	54.6	11	16	3.4	2.2	1700
8	FS8	7.90	6.4	2.5	10.6	76	39.7	8.8	20	3.8	2.8	1200
9	FS9	8.02	Ab	5.1	12.2	92	14.6	18.8	20	2.3	3.1	550
10	FS10	7.60	1.8	4.4	5.7	68	24.1	10.6	14	2.3	1.8	430