"physico-chemical Properties of Waste Water Quality of Ambabari Jaipur (rajasthan)."

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ABSTRACT :-

Waste water qualities of Ambabari of Jaipur city in Rajasthan were studied Pre mansoon,Mansoon and post mansoon (2015 to 2017) to assess its suitability for Irrigation purpose. Water samples from different sites were collected and seventeen physico-chemical parameters were analysed and values obtain were compared with standard values recommended by Bureau of Indian standards (BIS), Indian Council for Medical Research (ICMR), World Health organization (WHO) and United States Public Health (USPH) Standards. The corresponding water quality indices (WQI) were also worked out and reported. Analysis of results showed that water is unsuitable for irrigation purpose.

Key Words :- Water Quality index, Ground Water Physico-chemical, water quality, sodium, potassium.

Introduction:

As seen from space , one of the most unique features of our home planet is the water, in both liquid and frozen forms, that covers approximately 75% of the Earth's surface[6]. Believed to have initially arrived on the surface through the emissions of ancient volcanoes, geologic evidence suggests that large amounts of water have likely flowed on Earth for the past 3.8 billion years, most of its existence. As a vital substance that sets the Earth apart from the rest of the planets in our solar system, water is an indispensable resource that moves in the continuous sun powered water (or hydrologic) cycle and is a primary ingredient for the development and nourishment of life[13]. Water is everywhere on Earth and is the only known substance that can

Naturally exist as a gas, liquid, and solid[5]within the relatively small range of air temperatures and pressures found at the Earth's surface. Water is essential for life on Earth.

Material and Methods :-

Samples were collected in good quality polyethylene bottles[4] as per the standard procedure. Sampling has been carried out without adding any preservatives in rinsed bottles directly for avoiding any contamination and brought to the laboratory.. Reagents use for the present investigation were of AR Grade and double distilled water was used for preparing various solutions. The samples were analyzed as per the standard methods (APHA[14]1992, Trivedi and Goel 1984). Various physical parameters like pH, EC, DO and TDS were determined on the site with the help of digital portable water analyzer kit (CENTURY-CK-710) The chemical analysis was carried out for calcium (Ca^{2+}), Magnesium (Mg^{2+}), Chloride (Cl^{-}), Sulfate (SO_4^{2-}) Carbonate (CO_3^{2}) and Bicarbonate (HCO_3^{-1}) by volumetric tritration methods. While fluoride (F^{-}) by Spectro-photometric (AIMIL-C160-80314) method. The nitrate was estimated at wavelength 220 nm by Ultra violet Spectrophotometer (ELICO-CL-54D) method. Sodium (Na^{+}) and Potassium (K^{+}) by flame photometry (ELICO-CL-220) methods. The respective values for all these parameters are reported in Table No.2 and all results are compared with their standards limits recommended by ISI, ICMR and WHO.

Results and Discussion

Waste water samples from sampling points (WD) of **AMBABARI** were collected and analyzed as per standard methods. Sampling was done during three seasons (pre–monsoon, during monsoon and post–monsoon) throughout the two–years from various areas vicinal to Amanisha nalla during (April, 2015 to February, 2017). Results of three seasons physico–chemical and trace metals analysis are shown in Table A and B and trace metals analysis. Moreover suitability of water for irrigation is depended on the effect of some mineral constituents in the water on both the soil and the plant . TDS, conductivity, SAR, RSC and % Na are the important characteristicproperties of water of determine its suitability of irrigation proposes. GWW software was used to classify the wastewater quality and suitability of wastewater for irrigation purposes on the basis of Piper trilinear diagram (Figure 1) and USSL diagram (Figure 2).

The pH values of the wastewater varied from 7.21 to 7.90 with an average value 7.50, which indicates that water is slightly alkaline in nature. All the wastewater samples were within the permissible limit. TDS values varied from 863 to 1114 mg/l.The average value of TDS was 966 mg/L found in two years analysis.

Regarding to the TDS content the water is considered "satisfactory" for irrigation purposes.The most influential water quality guideline on crop productivity is the salinity hazard as measured by electrical conductivity (EC). The EC values of both years varied from 1460 to 1900seimens/cmfor wastewater samples.All the water samples fall in the "high salinity water (C3)" class . Mg^{2+} concentration varied from 34.00 to 71.74 mg/L, with an average value of 48.2 mg/L. and Ca^{2+} values varied from 80.16 to 144.29 mg/L, with an average value of 108.5 mg/L. The average Mg/Ca ratio during the year 2015 to 2017 in the study area was 0.44, which fall in under safe category with respect to Mg/Ca ratio.

In most water nearly all the hardness is due to calcium and magnesium. Total hardness varied between 365.3 to 600.44 mg/L with an average value of 469.5 mg/L. Based on average total hardness value, wastewater in the study area during 2015 t0 2017 was characterized as "very hard" . Hard water is not desirable for domestic water supplies, but it is considered good for irrigation. It helps keep soils in good physical condition, which favors good water penetration and easy tilling.Bicarbonate values varied from 262.30 to 439.20 mg/L.The average value of bicarbonate was 335.50 mg/L found in two years analysis. All RSC [21] values were found below the zero, which means Waters containing a carbonate plus bicarbonate concentration greater than the calcium plus magnesium concentration and these values fall in under "good" category with respect to RSC.Sodium values ranged from 93.47 to 180.30 mg/L and the average value of sodium was 148.4 mg/L all of the studied samples of both years and potassium values varied between 1.5 to 2.00 mg/L with an average value of 1.8 mg/L. Sodium concentration is important in classifying irrigation water because sodium reacts with soil to reduce its permeability. Sodium content is usually expressed in terms of percent sodium or soluble-sodium percentage. %Na values varied from 29.10 to 51.94 mg/L with an average value of 40.84 mg/L found in two years analysis. On the basis of these data it is revealed that waste water of the study area was fall in the water class "permissible" according to Wilcox [169]The sodium / alkali hazard is typically expressed as the sodium adsorption ratio (SAR). Sodium adsorption ratio varied from 1.82 to 4.10 meq/L. All samples fall in low sodium class (S1) . The analytical data plot on the US salinity diagram illustrates that all the ground water samples fall in the C3S1 quality with high salinity hazard and low sodium hazard, which can be used for irrigation on almost all type of soil with little danger of exchangeable sodium (Figure1). Chloride values ranged from 272.44 to 322.40 mg/L and the average value of chloride was 289.91mg/L all of the studied samples of both years. This range of chloride concentration revealed that the wastewater of the study area was usable for irrigation purposes

w.r.t. chloride. Sulphate values ranged between 67.95 to 255.10 mg/L during two years samplings. The average value of sulphate was 138.23 mg/L. This range of chloride concentration revealed that the wastewater of the study area was usable for irrigation purposes w.r.t. sulphate. Nitrate valuesranged from 50.00 to 85.00 mg/L and the average value of nitrate was 63.11 mg/L for all of the studied samples of both years.. The data table reveals that the fluoride values in both years varied from 1.60 to 4.00 mg/L. Most of the wastewater samples of study area were above the standard limit recommended by CPCB for discharge of environmental pollutants .. The data table reveals that the DO values in both years varied from 5.39 to 6.76 mg/L for all wastewater samples and there were not any large variations of DO values found and all the values were within the limit recommended by USPH standards. BOD values ranged between 34.00 and 46.00 mg/L during two years samplings. All these values were above the limit as prescribed by CPCB for discharge of environmental pollutants .

COD values were varied from 164.00 to 276.00 mg/L and all the values were within the permissible limit prescribed by CPCB for discharge of environmental pollutants [174]. The average value of COD was 216.33 mg/L. Copper concentration varied 0.05 to 0.07mg/L while Concentration of cobalt was found 0.02mg/L, Iron values of both years varied from 0.60 to 0.64mg/L. Cadmium, manganese and lead concentration was not detectable , Zinc values of both years varied from 4.67 to 5.47 mg/L and these values were found under the permissible limit prescribed by CPCB for discharge of environmental pollutants [174].Major cations and anions such as Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, CO_3^{2} , HCO_3 , SO_4^{2} and Cl in meq/L were plotted in Piper's trilinear diagram (Piper, 1953) to evaluate the hydrochemistry of wastewater of AMBABARI area with the help of GWW- software (Figure 1). On the basis of Walton's classification [165], most of the samples showed an excess of alkaline earth (Ca^{2+}+Mg^{2+}) over alkalies (Na^{+}+ K^{+}), and all the wastewater samples showed an excess of strong acids (SO_4^{2} + Cl) over weak acids (CO_3^{2} , HCO_3). The plot shows that most of the samples fall in the field Mixed type. In this type of water No specific cation-anion pair exceeds 50 percent of the total dissolvedconstituent load.

Conclusion:

Most of the parameters were found within the permissible range but some amount of contaminations with reference to TDS, TH, EC, BOD and COD in wastewater have been investigated in the study area. From the Piper trilinear diagram, it is observed that the majority of wastewater from sampling stations was mixed type. The values of sodium absorption ratio and electrical conductivity of the water were plotted in the US salinity laboratory diagram for irrigation water. All the samples fall in C3S1 quality with high salinity hazard and low sodium hazard, which is suitable for irrigation.

Table (A): Physico- Chemical Parameters of Wastewater of Ambabari Area During 2015 to 2017

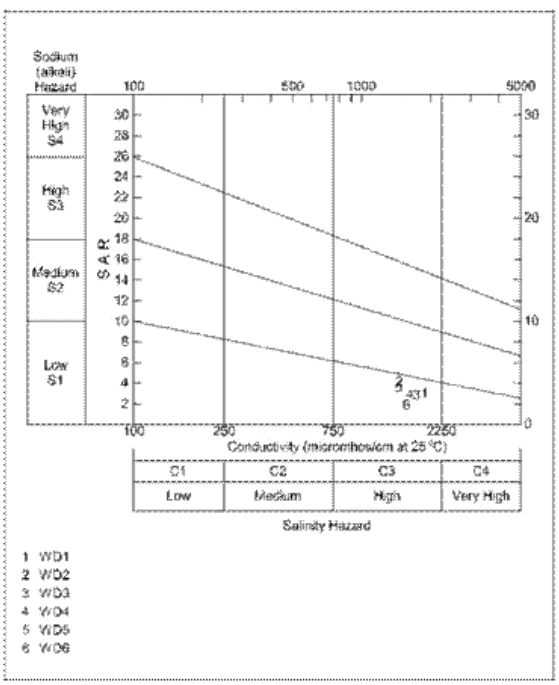
Code	Season	EC	pH	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	NO_3^{-}	F^{-}
WD1	Pre 2006-07	1900	7.21	122.24	71.74	168.00	2.00	0	341.60	299.91	179.00	51	1.60
WD2	Mon 2006-07	1473	7.30	80.16	40.13	180.30	1.84	0	262.30	277.41	93.19	58.65	4.00
WD3	Post 2006-07	1749	7.90	102.20	41.34	132.49	1.92	0	311.10	284.91	116.87	75.00	1.60

WD4	Pre 2007-08	1637	7.50	98.20	54.72	142.91	1.53	0	359.90	322.40	255.10	59.00	3.20
WD5	Mon 2007-08	1460	7.60	104.21	47.42	173.02	1.78	0	298.90	282.41	117.26	85.00	3.20
WD6	Post 2007-08	1578	7.50	144.29	34.05	93.47	1.50	0	439.20	272.42	67.95	50.00	1.60

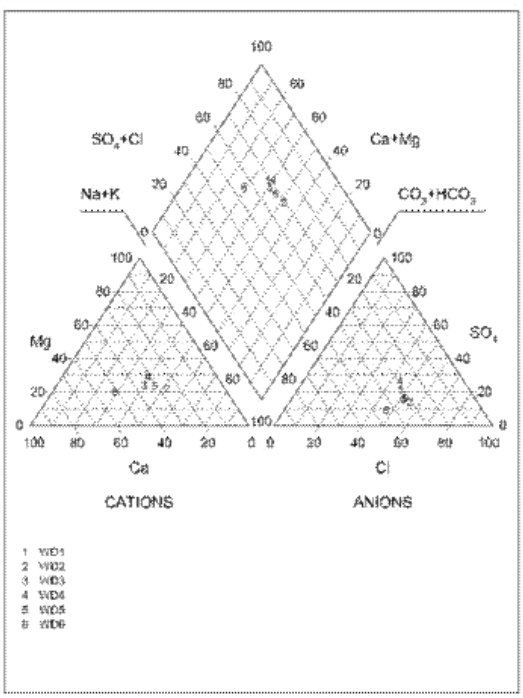
Table (B): Physico- Chemical Parameters of Wastewater of AMBABARI Area During 2015 to 2017

Code	Season	DO	BOD	COD	TH	TDS	%Na	SAR	RSC
WD1	Pre 2006-07	5.60	46.0	234.0	600.44	1064	38.01	2.98	-6.40
WD2	Mon 2006-07	5.81	36.0	224.0	365.29	863	51.94	4.10	-3.00
WD3	Post 2006-07	5.39	35.2	204.0	425.33	910	40.61	2.80	-3.40
WD4	Pre 2007-08	5.39	37.4	276.0	470.37	1114	39.96	2.87	-3.50
WD5	Mon 2007-08	6.76	44.0	196.0	455.36	961	45.42	3.53	-4.20
WD6	Post 2007-08	5.49	34.0	164.0	500.39	883	29.10	1.82	-2.80

Ussl Diagram of Waste Water of Ambabari



Piper Diagram of Waste Water of Ambabari



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References

1. Barbara, M. Linde., 2005. *Water on Earth*. Benchmark Education Company. Pelham, NY.
2. Sharma Surendra Kumar, Vijendra Singh and C.P. Singh Chandel, 2004. Ground Water Pollution Problems and Evaluation of Physico–Chemical Properties of Ground Water, E*nvironment & Ecology*, 22(Spl-2): 319–324.
3. Sharma, B.K., 2004. *Soil Pollution,* Krishna Prakashan Media (P) Ltd., Meerut.
4. Sharma, Surendra and Chandel, C.P.S. 2006. Physico-Chemical Properties of Ground Water of Dudu Block of Jaipur District. *EcologyEnvironment & Conservation*. 12(1), 141 – 147.
5. Sharma, Surendra and Chandel, C.P.S. 2006. Qualitative Aspects of Ground Water for Drinking Purpose of Bassi Block of Jaipur District (Raj.). *Aquacult*. 7(1): 61 – 72.
6. Sharma, Surendra and Chandel, C.P.S. 2004. Ground Water Pollution of Sanganer Block of Jaipur District in Rajasthan. *Journal of Environment and Ecology,* 22(4), 934–940
7. Walton, W.C., 1970. *Ground water resources evolution*. New York: Mc Graw Hill Book Co.
8. Water Quality Determination of Nitrate, 1986. International Organization for Standardization, Geneva, ISO 7890.
9. Webber, J.S., Covey, J.R., and King, M.V., 1989. Asbestos in Drinking Water Supplied through grossly deteriorated AC Pipe, *J. American Water Works Association,* 81(2): 80-85.
10. Wilcox, L.V., Magistad, O.C., Reitemeier, R.F., 1945. *determination of soluble salts in soils.* Vol 59 (1): 65-76.
11. Wilcox, L.V., 1948. The quality of water for irrigation use, (U.S. Dept., Agric. Tech. (Bull. 962, pp. 40). Washington, D.C.
12. Yadav, B.R. and Khera, M.S. 1993. *Analysis of irrigation water ln.* Methods of Analysis of Soil, Plants, Water and Fertilizer, Ed. H.L.C. Tandon, 83 – 116.
13. V.P. Kudesta, Water Pollution, Pragati Prakashan, Meerut (1985)
14. APHA. Standard Mehtods for the Examination of Water and Waste
15. Water, edited by Lenore S. Clesceri, 17 th edition, APHA, AWWA, WPCE, Washington DC, (1989)
16. Manual of Drinking Water Standards, IS-BIS, New Delhi (1991)
17. Manual of Drinking Water Supply, 2nd Special Report Series No. 44 ICMR, New Delhi (1975)
18. Guidelines for Drinking Water, World Health Organization, Geneva, Vol. 1, pp. 52-82 (1993)