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Analysis of Water Quality of Bharatpur

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Abstract: *The availability of groundwater neither unlimited nor protected deterioration, in most of the instances the extraction of excessive qualities of ground water has resulted in drying up of wells, damaged ecosystem, land subsidence, saltwater intrusion and depletion of resources. the rate of depletion of ground water level and determination of ground water quality is concern in major cities and towns of countries. It is now recognized that the quality of ground water is as important as its quantity. Bharatpur is the well known place because of "Keoladeo Ghana National Park" due to which it is a world fame tourist place. The present study deals with the water quality of Bharatpur district, which is assessed by examine various physico-chemical parameters of open wells, bore wells and hand pumps. The studies reveal that the water of most of the sampling area is hard and contaminated with higher concentration of total dissolved solids.*
Keywords: *Water pollution, Health problems, Bharatpur, Analytical techniques, Standard Data*

I. INTRODUCTION

Water is life. Without water, man's existence on the earth would be threatened and he would be driven close to extinction. All biological organisms depend on water to carry out complex biochemical processes which aid in the sustenance of life on earth. Over 70 per cent of the earth's surface materials consists of water and apart from the air man breathes, water is one of the most important elements to man. The quality of water is of great importance also for human lives as it is commonly consumed and used by households. In industry, it serves as a solvent, substrate or Catalyst of chemical reactions (Goncharuk 2012; Holt 2011; Van Leeuwen 2012; Petraccia et al. 2011). The physical, chemical and bacterial characteristics of ground water determine its usefulness for domestic, industrial, municipal and agricultural applications (CGWB, 2004 and Adhikary et al. 2010). The quality of water is more important compared to quantity in any water supply planning, especially for drinking purposes (CPHEEO 1998, Patnaik et al. 2002 and Tanriverdi et al. 2010).The accumulation of high levels of pollutants in water may cause adverse effects on humans and wildlife, such as cancer, reproductive disorders, damage to the nervous system and disruption of the immune system. Thus, it is an important requirement to interpret water quality status, identify significant parameters, and characterize the pollution sources as well as their quantitative contributions to water quality issues for conducting pollution management (Zhou et al. 2011). Water pollution means contamination of water by foreign matter such as micro-organisms, chemicals, industrial or other wastes, or sewage. Such matters deteriorate the quality of the water and renders it unfit for its intended uses. Water pollution is the introduction into fresh or ocean waters of chemical, physical, or biological material that degrades the quality of the water and affects the organisms living in it. Although some kinds of water pollution get occur through natural processes, it is mostly a result of human activities. The water we use is taken from lakes and rivers, and from underground [ground water]; and after we have used it and contaminated it – most of it returns to these locations. Water pollution also occurs when rain water runoff from urban and industrial area and from agricultural land and mining operations makes its way back to receiving waters (river, lake or ocean) and in to the ground. Bharatpur (Fig.1: Study Area), eastern gate of Rajasthan is situated between 26^{o} 22' to 27^{o} 83' north latitude and 76^{o} 53' to 78^{o} 17' east longitude. Bharatpur is well known place because of Keoladeo Ghana National Park. Keoladeo National Park is the only the largest bird sanctuary in India. "Ajan Bandh" is the main water source to fill the various lakes, ponds of the park and villagers use this water for drinking purposes. In the present study several points of ground water sources such as open wells, bore wells and hand pumps have been selected to check the potability of water.

II. MATERIAL METHOD

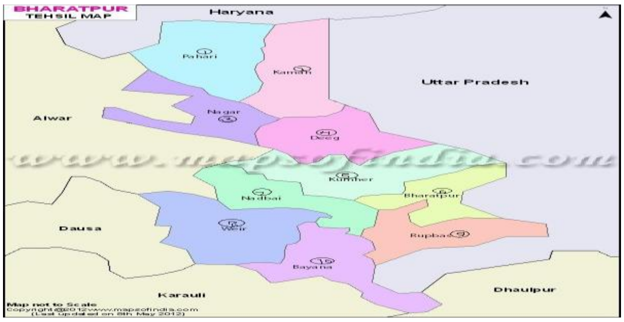
Water quality is the physical, chemical and biological characteristics of water in relationship to a set of standards. Water quality is a very complex subject, in part because water is the complex medium intrinsically tied to the ecology of the earth. The physico – chemical quality of drinking water was assessed during the month of January, 2011 by standard methods as suggested by APHA (1995) and compared with the values as guided by ICMR.

The present research work is based on 15 ground water samples collected from open wells, bore wells and hand pumps in cleaned and screw capped polythene bottles. At the time of sampling, these bottles are thoroughly raised 23 times using the ground water to be sampled.

Fig . 1

These water samples are collected after pumping the water for 10 minutes (CPHEEO 1998, Chhabra 2008 and Shyam & Kalwania 2011).

All the samples were properly labeled as 1,2,3,4,5,6,7,8,9 and 10 and a record was prepared which is indicated in Table 1.



III. RESULTS AND DISCUSSION

The physico-chemical parameters which were analyzed in Post-monsoon season, January 2012 have been shown in Table-2.

III.1. ***Colour:*** The colour of a small water sample is caused by both dissolved and particulate material in water, and is measured in Hazen Units [HU]. Colour in water may be caused because of the presence of natural metallic ions (iron and manganese) humus, planktons etc. The presence of colour in water does not necessarily indicate that the water is not potable. Colour is not removed by typical water filters; however, slow sand filters can remove colour, and the use of coagulants may also succeed in trapping the colour causing compounds within the resulting precipitate. In the present study water is almost colourless.

III.2 ***Odour:*** When minerals, metals and salts from soil etc. come in contact with water, they may change its taste and odour. Analyzed water samples are found odourless.

III.3 ***Temperature:*** Use appropriate thermometer for calculating water temperature.

Water temperature affects the ability of water to hold oxygen, the rate of photosynthesis by aquatic plants and the metabolic rates of aquatic organisms. Temperature of water samples is varied from 26.0^{o}C to 27.2^{o}C the variation of the water temperature having more effect directly or indirectly on all life processes.

III.4 ***PH:*** Ph is measured by Ph meter.

The balance of positive hydrogen ions (H+) and negative hydroxide ions (OH-) in water determines how acidic or basic the water is. In pure water, the concentration of positive hydrogen ions is in equilibrium with the concentration of negative hydroxide ions, and the pH measures exactly 7. pH is a term used to indicate the alkalinity or acidity of a substance as ranked on a scale from 1.0 to 14.0. In the present study area the pH value ranged from 7.70 to 8.76. A pH range from 7.0 to 8.5 is desirable concentration as per guided by ICMR. It is known that pH of water does not cause any severe health hazard. Water of study area is somewhat alkaline.

III.5 ***Dissolved Oxygen (D.O.):*** DO can be determining by use of DO meter as well as measure by Winkler titration method. DO is the most important water quality parameter which shows the amount of oxygen present in water. It gets there by diffusion from the surrounding air, aeration of water that has jumbled over falls and rapids; and as a waste product of photosynthesis. In general, rapidly moving water contains more dissolved oxygen than slow or stagnant water and colder water contains more dissolved oxygen than warmer water. In the studied water samples DO ranged from 4.6 to 7.8 mg/l. As DO level falls; undesirable odours, tastes and colours reduce the acceptability of water. The lowest DO value indicates not good healthy condition for the community (Jeena. B et al 2003).

III.6 ***Total Alkalinity*****:** Total alkalinity is calculate by Titration Method. Alkalinity is not a pollutant. It is a total measure of the substance in water that have "acid-neutralizing" ability. The main sources of natural alkalinity are rocks, which contain carbonate, bicarbonate, and hydroxide compounds, borates, silicates, and phosphates may also contribute to alkalinity. Total alkalinity is the total concentration of bases in water expressed as parts per million (ppm) or milligrams per liter (mg/l) of calcium carbonates ($CaCO_3$). These bases are usually bicarbonates (HCO_3) and carbonates (CO^{2-}_3), and they act as a buffer system that prevents drastic changes in pHs Water with high total alkalinity is not always hard, since the carbonates can be brought into the water in the form of sodium or potassium carbonate. The desirable limit of total alkalinity is 200 mg/l (ICMR). The value of study area is ranged from 161 to 202 mg/l. Alkalinity in itself is not harmful to human being, but in large quality, alkalinity imparts bitter taste to water.

III.7 ***Total Hardness:*** Complexometric titration using EDTA. The total hardness is the sum of the hardness formers in a water (Ca, Mg, Ba and Sr ions) in mmol/l. Originally hardness was understood to be a measure of the capacity of water to precipitate soap. Soap is precipitated chiefly by the calcium and Mg ions present. The maximum limit of hardness in drinking water is 600 mg/l (ICMR). Total hardness is measured in grains per gallon (gpg) or parts per million (ppm). If water contains less than 3.5 gpg, it is considered soft water. If it contains more than 7 gpg, it is considered hard water.

Hardness	
Description	Hardness range (mg/l as $CaCO_3$)
Soft	0-75
Moderately hard	75-100
Hard	100-300
Very Hard	> 300

The total hardness value ranged in the studied area from 96 to 488 mg/l. So, the water of almost all sampling stations is hard.

III.8 ***Calcium Hardness:*** Complexometric titration using EDTA. A measure of the amount of calcium in water measured in ppm. High levels can cause scale buildup. Low levels can cause etching and equipment corrosion. Calcium hardness is sometimes confused with the terms water hardness and total hardness. Too little calcium hardness and the water are corrosive. Too much calcium hardness and the water are scale forming. The maximum permissible limit of calcium hardness is 200 mg/l (ICMR). The value of sampling stations ranged from 32.06 to 68.13 ppm. Thus sampling stations 5 and 12 have greater calcium hardness.

III.9 ***Magnesium Hardness:*** Complexometric titration using EDTA. Magnesium salts have a laxative and diuretic effect. The maximum permissible limit of magnesium hardness is 150 mg/l (ICMR). Mg hardness value in studied area ranged from 11.54 to 91.78 ppm.

III.10 ***Chloride:*** Using silver nitrate titration method for calculate chloride in water. The maximum permissible concentration of chloride is 1000 mg/l. (ICMR). So except some points the chloride contents of water samples are in limit. It varies from 53.76 to 406.07 ppm.

III.11 ***Sulphate:*** Ion chromatography is the only instrumental method for the direct determination of sulphate. Sulphate may be precipitated either with Ba^{2+} or 2-aminoperimidinium salts. The precipitate may be weighed for a direct determination of the sulphate as a gravimetric method.

The maximum permissible limit of sulphate is 400 mg/l (ICMR). In the sampling areas the sulphate concentration ranged from 15.25 to 71.00 ppm. Waters with higher concentration of sulphate may cause intestinal disorders.

Nitrate:

Use spectrophotometer for calculating nitrate in water.

Nitrate is a major ingredient of farm fertilizer and is necessary for crop production. Nitrate stimulates the growth of production. Nitrate stimulates the growth of plankton and waterweeds that provide food for fish.Maximum permissible limit of nitrate is 50 mg/l (ICMR). Nitrate in water supplies in concentration over 100 mg/l. causes “methamoglobinamia”.

Generally NO3- concentration is found in higher concentration in rural areas because of runoff of nitrate rich fertilizers and animal manure into the water supply. The nitrate value ranged in investigated area is between 17.06 to 93.2 ppm.

III.12 Total Dissolved Solids (TDS): Use an appropriate TDS meter. Freshwater meters: 0-1990 ppm (parts per million). The term TDS describes all solids [usually mineral salts] that are dissolved in water. Desirable limit of TDS is 500 mg/l (ICMR). All the values obtained are much higher than the limit except points-1 and 2. It is an important parameter for imparts a peculiar taste to water and reduce its potability.

III.13 Fluoride: fluoride can be determined by spectrophotometry or by ion-chromatography. Fluoride is more common in ground water than in surface water. The main sources of fluorine in ground water are different fluoride bearing rocks. The guideline value of fluoride is 1.5 mg/l in drinking water. In studied area, it ranged between 0.010 to 1.180ppm.

III.14 Electrical Conductivity: Electrical conductivity estimates the amount of total dissolved salts (TDS), or the total amount of dissolved ions in the water. Its SI derived unit is the siemens per meter, (A2S3m-3 Kg-1) or more simply, Sm-1. It is the ratio of the current density to the electric field strength or, in more practical terms; is equivalent to the electrical conductance measured between opposite faces of a 1-meter cube of the material under test. Pure water is a poor conductor of electricity. Acids, bases and salts in water make it relatively good conductor of electricity. Electrical conductivity in studied area ranged between 7.5×10^2 to 2.1×10^3 μmhos/cm.

IV. CONCLUSIONS

The present results of water investigation show that the waters of study area are highly contaminated with total dissolved solids. Because of high concentration of TDS water loss its potability and high concentration of TDS also reduces the solubility of oxygen in water. Water of almost all study points are hard also because of this people of Bharatpur area are facing many problems like stomach diseases, gastric troubles etc. At some points nitrate level is also high than the permissible limit. It is recommended that water should be used after boiling by the people of Bharatpur because after boiling the water, temporary hardness [carbonate hardness] can be removed and concentration of total dissolved solids can also be decreased. Alum treatment is also a good option to make potable the water.

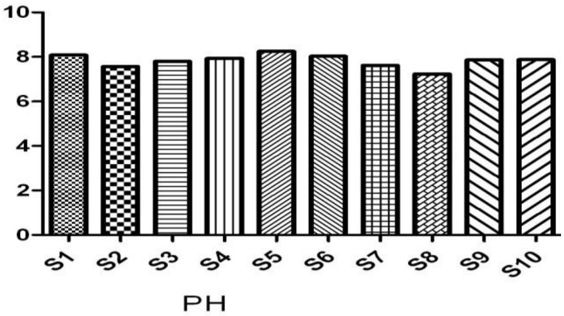
TABLE-1 Area, sourceof the sampling stations

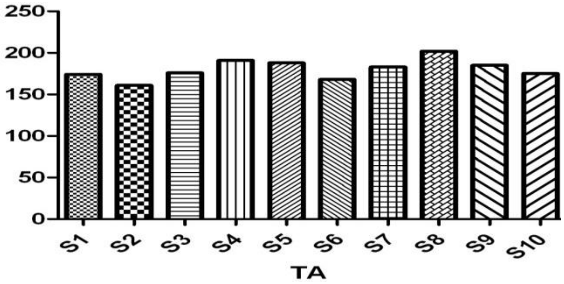
Sample No.	**Area**	**Source**
1	Pahari	Bore Well
2	Kaman	Hand Pump
3	Nagar	Bore Well
4	Deeg	Bore Well
5	Kumher	Bore Well
6	Bharatpur	Hand Pump
7	Nadbai	Bore Well
8	Weir	Hand Pump
9	Rupbas	Hand Pump
10	Bayana	Hand Pump

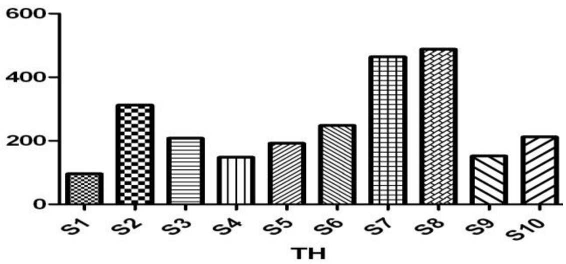
TABLE-2

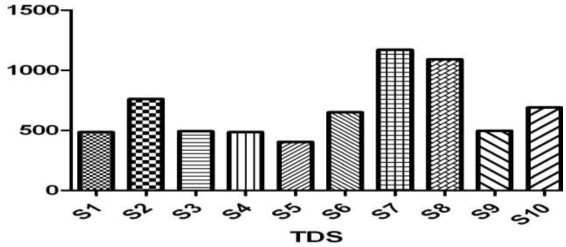
PARAMETER	**S. 1**	**S. 2**	**S. 3**	**S. 4**	**S. 5**	**S. 6**	**S. 7**	**S. 8**	**S. 9**	**S. 10**
pH	8.09	7.57	7.80	7.94	8.25	8.03	7.62	7.24	7.86	7.88
EC	8.8×10^2	1.5×10^3	9.0×10^2	8.9×10^2	7.5×10^2	1.2×10^3	2.1×10^3	1.9×10^3	8.6×10^2	1.3×10^3

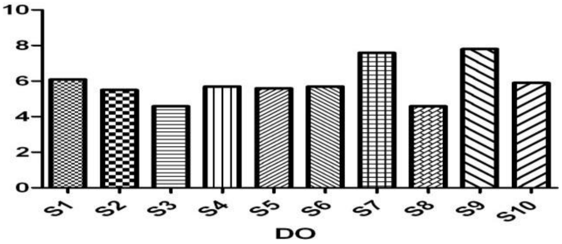
TDS	485	760	493	485	404	650	1170	1090	497	690
TH	96	312	208	148	192	248	464	488	152	212
TA	174	161	176	191	188	168	183	202	185	175
DO	6.1	5.5	4.6	5.7	5.6	5.7	7.6	4.6	7.8	5.9
Ca^{+2} ppm	32.87	67.33	55.31	32.06	48.90	56.91	64.93	68.13	44.89	49.70
Mg^{+2} ppm	14.04	41.53	20.19	19.61	20.18	30.57	87.10	91.78	11.54	25.38
Na^{+} ppm	94.99	110.86	51.29	83.26	89.72	90.39	176.87	118.22	50.57	138.69
Cl^{-} ppm	81.95	262.13	69.69	87.93	84.03	149.99	406.07	340.14	53.76	197.85
SO_4^{2-} ppm	39.00	51.25	21.50	50.50	28.00	15.25	41.25	64.75	14.75	71.00
NO_3^{-} ppm	41.4	72.6	69.6	18.2	60.0	93.2	80.8	46.8	17.60	56.4
F^{-} ppm	0.250	0.050	0.130	0.010	1.180	0.130	1.30	0.560	0.170	0.020

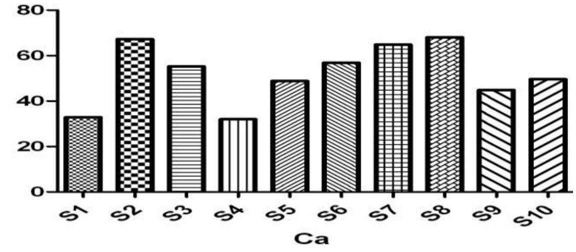


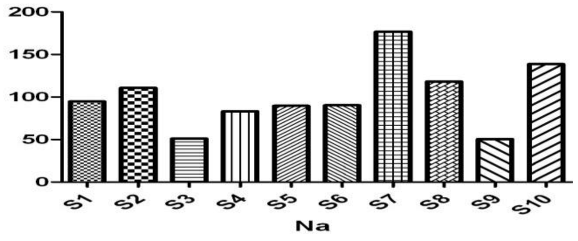


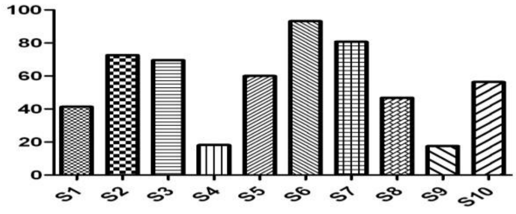




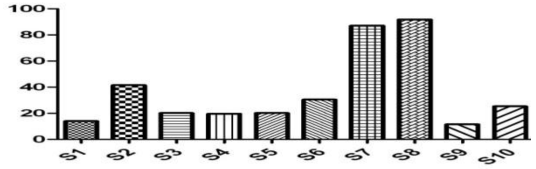


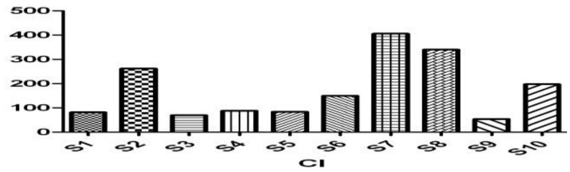






NITRATE





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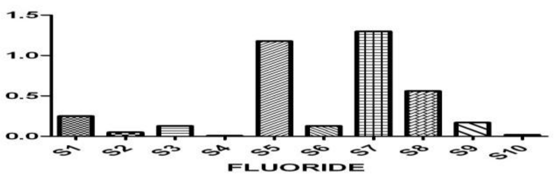

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