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PHYSICO-CHEMICAL ANALYSIS OF SELECTED GROUND WATER SAMPLES OF RURAL AREAS OF JAIPUR, RAJASTHAN

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Abstract: The aim of present study was to assess the status of the groundwater in rural areas of Jaipur city. People on globe are under tremendous threat due to undesired changes in the physical, chemical and biological characteristics of air, water and soil. Due to increased population, urbanization, industrialization, use of fertilizers water is highly polluted with different harmful contaminants Natural water resources are being contaminated due to weathering of rocks and leaching of soil, mining processing etc. It is necessary that quality of drinking water should be checked at regular time interval to prevent various water born diseases. In present analysis physico-chemical parameter of drinking water viz. pH, hardness, TDS, residual chlorine, dissolved oxygen, electrical conductivity, Free CO_2 have been analyzed. Drinking water quality of 8 villages of Amber District Jaipur, Rajasthan was analyzed to identify the nature and quality of water. The drinking water samples were collected in clean polythene one liter cans and subjected for analysis in laboratory. The main objective of the present paper is to aware people of concerned area about the water quality and concerned health hazards.
Keywords: Groundwater; Hardness; Physicochemical Parameters; TDS.
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INTRODUCTION

Water plays vital role in human life. It is extremely essential for survival of all living organisms. Groundwater is ultimate, most suitable fresh water resource with nearly balanced concentration of the salts for human consumption. Over burden by means of population pressure, unplanned urbanization, unrestricted exploration policies and dumping of the polluted water at inappropriate place enhance the infiltration of harmful compounds to the groundwater. The quality of water is of vital concern for the mankind since it is directly linked with human welfare. There are several states in India where more than 90%populations are dependent on groundwater for drinking and other purpose (Ramachandraiah, 2004; Tank and Singh, 2010). The uncontrolled disposal of industrial and urban wastes and the use of chemical substances agriculture (fertilizers, herbicides and pesticides) are the primary causes of groundwater contamination (Ullah *et al,* 2009). During last decade; this is observed that groundwater get polluted drastically because of increased human activities. Consequently, number of cases of water borne diseases has been seen that is a cause of health hazards. The status of the groundwater depends on a large number of individual physicochemical parameter and heavy metals. Pollutants are added to the ground water system through anthropogenic activities and natural processes (Esteban *et al*, 2014). The uncontrolled disposal of industrial and urban waste and use of chemical substances (fertilizers, pesticides, herbicides) are the primary cause of the ground water contamination. Kukas is surrounded by RIICO Industrial area. Solid waste from industries is being dumped near the factories and subjected to reaction with percolating rain water and reaches the ground water level. The percolating

water picks up a large amount of dissolved constituents and reaches the aquifer system and thus it contaminates the ground water. The specific objectives of the study were however to assess physical and chemical properties of groundwater in the study area.

EXPERIMENTAL

Study Area: The Kukas rural area of Jaipur City, Area in Jaipur district is situated in north-east part of city.

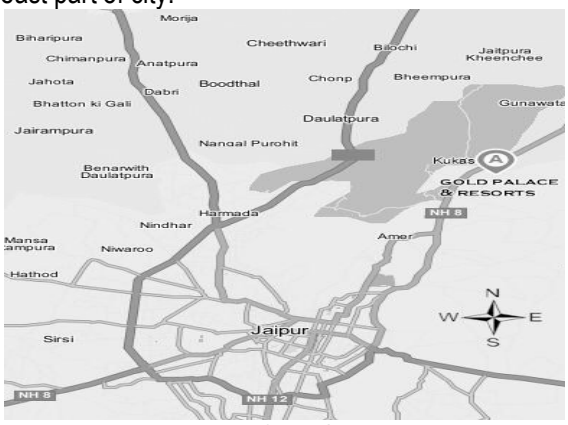

Figure 1. Map of the Study area

Sample Collection: Water samples from the five selected sites namely Achrol, Bhanpur, Amer, Kukas, Nangal Susawatan were collected during September to November 2014 and taken in pre-cleaned polyethylene bottles. Samples were analyzed immediately for parameters, which need to be determined instantly and rest of samples were refrigerated at to be analyzed later (APHA, 1989).

Physico-Chemical Analysis: The collected samples were analyzed for major physical and chemical water quality parameter like pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Hardness (TH), Free Chlorine, Alkalinity, Dissolved CO_2 and Dissolved Oxygen. Dissolved carbon dioxide is measured by acid base titration. Collected samples are titrated with standardized NaOH. The Winkler test is used to determine the concentration of dissolved oxygen in water samples. Dissolved oxygen (DO) is widely used in water quality studies and routine operation of water reclamation facilities. An excess of manganese (II) salt, iodide (I^-) and hydroxide (OH^-) ions is added to a water sample causing a white precipitate of $Mn(OH)_2$ to form. This precipitate is then oxidized by the dissolved oxygen in the water sample into a brown manganese precipitate. In the next step, a strong acid (either hydrochloric acid or sulfuric acid) is added to acidify the solution. The brown precipitate then converts the iodide ion (I^-) to iodine. The amount of dissolved oxygen is directly proportional to the titration of iodine with a thiosulfate solution (Chiya and Izumi, 1995).

RESULT AND DISCUSSION

The average results of the physicochemical parameters for water samples are presented in Table 1. The quality of water resources depends on the management of the water sources. This would include anthropogenic discharge as well as the natural physicochemical properties of the area.

Table 1. Physioco-chemical Study of Water*

Parameters	Sampling Points			
	S1	S2	S3	S4
pH	7.96	8.35	7.72	7.84
EC	14.924	23.944	10.824	19.516
DO	32	32	36	34
Chloride	0.02	0.04	0.15	0.12
Total Hardness	460	580	960	680
CO_2	3	4	3	5
TDS	320	420	280	345
Alkalinity	170	220	160	200

All parameters are in mg/L except pH and EC, EC is in ms/cm. *Average

pH: pH is considered as an important ecological factor and provides an important information in many type of geochemical equilibrium or solubility calculation (Shyamala *et al.,* 2008). Maximum pH was recorded at sampling area 2. Water is slightly alkaline in nature due to the presence of various carbonates, bicarbonates and various other salts. According to WHO (1992) standards, best and ideal pH value for human consumption is 7.0, so water must be treated before prior to its use. The pH of drinking water can be adjusted by chemical, electrochemical and biological treatment.

EC: Electrical Conductivity is a useful tool to evaluate the purity of water (Acharya *et al,* 2008). EC values were in the range of 10.824 to 23.844mS/cm. EC values for all the investigated samples were found to be greater than the limit

prescribed by WHO. High EC values indicate the presence of high amount of dissolved inorganic substances in ionized form.

TDS: Total Dissolved Solids usually related to conductivity. Water containing more than 500 mg/l of TDS is not considered desirable for drinking water supplies, though more highly mineralized water maybe used where better quality water is not available (Jain, 2002). The maximum TDS was found as 420 mg/L at sampling location S2 and minimum 280 mg/L was at sampling location S2.

Total Hardness: Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water (Angino, 1983).Total Hardness was found in the sample water ranges from 400 to 600 mg/L. The desirable limit of drinking water hardness is 300 ppm (ICMR) and for washing water is 500 ppm. Water hardness is generally because of the geochemical formulations of water (Patil and Patil, 2010**)** and due to presence of various salts of calcium and magnesium (bicarbonates, carbonates, sulphates, chlorides etc.). Inadequate intakes of calcium have been associated with increased risks of osteoporosis, nephrolithiasis (kidney stones), colorectal cancer, hypertension and stroke, coronary artery disease, insulin resistance and obesity. Increased intake of magnesium salts may cause a temporary adaptable change in bowel habits (diarrhoea) and is the cause of hyper magnesia in which human and animals are unable to excrete magnesium from body (WHO, 2009). Temporary hardness of water can be reduced by boiling and permanent hardness can be treated by various methods (Gupta and Jain, 2009).

Free Chlorine: Chlorine is a greenish-yellow gas that dissolves easily in water. It has a pungent, noxious odor that some people can smell at concentration above 0.3 parts per million. Because chlorine is an excellent disinfectant, it is commonly added to most drinking water supplies. According to some standards, water is permissible up to, 0.3 parts per million. Chlorine was found in the sample water ranges from 0.02 mg/L to 0.1 mg/L. which shows the values within the limit specified by the WHO. The concentration of free residual chlorine should be between 0 to 1 ppm excess chlorine in water can lead to various negative health effects (Hartesely, 2000). But all collected samples have free chlorine level within limits.

Alkalinity: Alkalinity is a measure of the capacity of water to neutralize acids. Alkaline compounds in the water such as bicarbonates (baking soda is one type), carbonates, and hydroxides remove H^+ ions and lower the acidity of the water (which means increased pH). They usually do this by combining with the H+ ions to make new compounds. Without this acid-neutralizing capacity, any acid added to a stream would cause an immediate change in the pH. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. It's one of the best measures of the sensitivity of the stream to acid inputs. Alkalinity in streams is influenced by rocks and soils, salts, certain plant activities, and certain industrial wastewater discharges. Alkalinity can be removed by reverse osmosis, along with other total dissolved solids. Other removal methods like distillation and deionization remove total dissolved solids and alkalinity, but they are less suitable for household use than reverse osmosis, but can be used at community level (Schoeman *et al.,* 2003; Cynthia *et al,* 2003).

Free CO_2: Carbon dioxide quickly combines in water to form carbonic acid, a weak acid. The presence of carbonic acid in waterways may be good or bad depending on the water's pH and alkalinity. If the water is alkaline (high pH), the carbonic acid will act to neutralize it. But if the water is already quite acid (low pH), the carbonic acid will only make things worse by making it even more acid (Gupta and Jain, 2009).

Dissolved Oxygen: Dissolved oxygen is oxygen that is dissolved in water. It gets there by diffusion from the surrounding air, aeration of water that has tumbled over falls and rapids; and as a waste product of photosynthesis. DO levels fluctuate seasonally and over a 24-hour period. They vary with water temperature and altitude. Cold water holds more oxygen than

warm water and water hold less oxygen at higher altitudes (Gupta and Jain, 2009).

CONCLUSION

Analysis of collected data and its comparison with standard parameter shows adequacy and suitability of water for drinking. Minorfilteration, reverse osmosis and deionization methods are suggested for further purification of water.

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