Assessment of Ground Water Quality and its Impact on Health of people around Rewa City, MP, India

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Abstract

In the present study ground water is used as sample and analysed for various characteristics. Total 6 samples were collected from different parts of Rewa city (M.P.) and their pH, temperature, TDS, total hardness, calcium and magnesium hardness, carbonate, bicarbonate, odour and colour were detected. It is observed that people who are using ground water without any pre-treatment for their drinking purpose are suffering from different kind of diseases like hair fall, stomach pain, kidney failure, skin diseases, acidity etc. The main objective of this study was to find out the quality of drinking water present in Rewa city and its impact on human health. Findings showed that the ground water of Rewa city contain high amount of dissolved particle which can cause gastrointestinal irritation and contains high amount of calcium and magnesium. Variation in pH is also observed with the change of sampling site which may affect mucous membrane. By all findings it is suggested that the ground water of various sites is not suitable for drinking purpose without any pre-treatment.

Introduction

Ground water is the major sources of drinking water all most the world. Underground water may contain high amount of different kind of ions and salts which are soluble in water and directly affect the quality of water, only 1% pure water is available for drinking purpose, rest are not available for use. Underground water is the most commonly used source of domestic use[1]. Contamination of ground water is a major problem to public health in all over the world. Quality of drinking water is poorly managed and monitored. The quality of ground is affected by the use of various products in agriculture like pesticides, insecticides and other chemical agents used to kill pests and other soil micro-organism. Apart from that rapid industrialization and urbanization causes several types of contamination in ground water[2]. Most of the drinking water quality parameters are set by WHO are frequently violated. Ground water is mainly contaminated by human activities like improper disposal of municipal and industrial waste, use of chemicals in agriculture[3]. Water is more polluted where the human population density is high. Once the ground water is contaminated it is not very easy to clean it. The flow of ground water is usually slow as compare to surface water so the concentration of contaminants gets concentrated. The concentration of contaminant depends upon flow of ground water and availability of waste. Wells, hand pump and municipal supply are the major source of ground water. Presence of contaminant near the source may affect the quality of ground water. According to world health organization (WHO), 4 Billion cases of diarrhoea and 2.2 million deaths were estimated annually. Use of unsafe water has been implicated as one of major cause of various diseases. The quality of ground water is continuously decreasing with the increase of human population and urbanization[4]. According to united nation report very less amount of water is consumable out of total available water. Now it is very much important to examine the quality of ground water and total pollution by which it can affect human health. Various programmes are running across the world to detect the water pollution by scientist groups and laboratories. The main objective of this work was to detect amount of pollutant present in ground water[5].

Material and Methods

The present assessment is based on experimental analysis and survey method with various laboratories and scientist services total 6 samples. Were collected from different sites of Rewa city and samples were stored in sterilized bottles to prevent any contamination that can change the exact quality of sample water. All containers labelled correctly to eliminate the mixing of samples. The temperature of sample water was tested at the sampling site using thermometer and samples were transported to lab for further examination. All analysis was carried out as per Indian standard specification for drinking water IS: 10500. The pH of the sample is tested using pH meter using standard solution, total dissolved solids in water determined using TDS measurement apparatus, total hardness, calcium and magnesium of water sample determined by EDTA method. Carbonate and Bicarbonate determined by titration method.

Results and Discussion

pH: the value of pH can be affected by the reaction of carbon dioxide and by the presence of organic and inorganic solutes in water. pH of water can be changed with the change of other physio-chemical parameters. The pH of samples was found in the range of 7.8-8.5 and was within the average limit for domestic use according to APHA. According to drinking water specification the value of pH for domestic use should range within 6.5-8.5. High level of pH can affect mucous membrane and water supply system. High value of pH may be due to waste discharge and decomposition of organic matter in the water[6].

TDS (Total Dissolved Solids): TDS of the samples was between 620-750 mg/lit. According to WHO (world health organisation) the value of TDS for drinking water is 500 mg/lit. Beyond this range the water may cause several diseases which are not water borne but the cause of disease is presence of excess salt. The total value of cation and anion in water is known as total dissolved solid concentration[7]. Therefore the total dissolved solid measurement provides a result of presence of cation and anion in water. The taste of water can be affected by the high amount of TDS, it may be bitter, salty or metallic and may contain unpleasant odour. Apart from that it may be less thirst quenching. Presences of ion cause precipitate on fixtures so that the efficiency of water filter can be reduced[8].

Hardness: the value of total hardness were found in the range of 160-290 mg/lit. Calcium and magnesium were present in the range of 36-72 ppm and 18-40 ppm respectively. High degree of hardness in water may cause several diseases to humans which are cardiovascular disease, kidney stones, risk of gastric cancer and possibility of malformation of central nervous system[9].

Mainly polyvalent ions from sedimentary rocks are responsible for hardness of water. Sedimentary rocks contain calcium and magnesium which is principal ions for the hardness of water, most considered is limestone and chalk[10].

Calcium and magnesium are important minerals and very useful for human health in various respects. Insufficient consumption of calcium and magnesium may be dangerous for human health. Recommended daily dose of these elements have been set at national and international level[11]. The daily dose differs individually according to their needs. Insufficient availability of calcium may cause different kind of diseases like osteoporosis, hypertension, stroke, colorectal cancer, nephrolithiasis, coronary artery disease and obesity. Most of these disorders can be treated but cannot be cured. Calcium is passed out by the kidney in people who do not have renal impairment when high amount of calcium is absorbed. Consumption of high calcium may be dangerous to kidney[12].

Various minerals like zinc, iron, magnesium, and phosphorous are usually present in intestine to which calcium can interact their by absorption of these elements can be reduced. Present data do not show strong evidence that these minerals are depleted when high calcium containing diet is consumed. No strong evidence is present for the role of calcium as a contributory element for these diseases. Requirement of calcium is strongly suggested for bone health and bone density[13].

Magnesium is essential element in biological system. It is a rich cation in body and intracellular fluid. Magnesium acts as co-factor for various cellular enzymes which are involved in energy metabolism. It is also involved in protein and nucleic acid synthesis and necessary for ATP to be biologically active. Apart from that it plays important role in cell membrane, cell wall and drug binding. In animals different concentration of magnesium is present in different cells. Low level of magnesium is found to be associated with endothelial dysfunction, increased vascular reaction and decreased insulin sensitivity[14]. It also participates in hypertension, coronary heart disease, diabetes and other metabolic syndrome. Magnesium deficiency may cause seizures, abnormal heart rate, muscle contraction and muscle twitching[15]. Increased consumption of this ion may cause change in bowel habits like diarrhoea but rarely causes hypermagnesaemia in people who have normal kidney function[16]. Carbonate was in the range of 18-22 ppm and bicarbonate was 95-150 ppm.

Table-1
Result of chemical analysis of water samples collected from various sites of Rewa city

Sample No.	Colour	odour	Temp. (°C)	pH	TDS (ppm)	Total Hardness	Bicarbonates (ppm)	Carbonate (ppm)	Calcium Hardness (ppm)	Magnesium Hardness (ppm)
S 1	Colourless	odourless	31	8.1	750	220	95	19.00	36.00	20.00
S 2	Colourless	Odourless	30	7.8	700	270	105	20.00	45.00	24.00
S 3	Colourless	Odourless	28	8.2	640	250	125	19.00	54.00	18.00
S 4	Colourless	Odourless	29	7.9	670	280	150	18.00	49.00	26.00
S 5	Colourless	Odourless	30	8.4	620	160	135	21.00	68.00	40.00
S 6	Colourless	Odourless	31	8.5	647	290	145	22.00	72.00	35.00

Table-2
Indian Standard Specification for Drinking Water IS: 10500

Parameters	Desirable limit for drinking water	Remarks
Colour hazen units	5	May be extended up to 50
Odour	Un-objectionable	--------
pH Value	6.5-8.5	No Relaxation
Total hardness mg/I	300	May be extended upto 600
TDS mg/I	500	May be extended upto 2000
Calcium mg/I	75	May be extended upto 200
Magnesium mg/I	30	May be extended upto 100
Carbonate	--------	----------
Bicarbonate	--------	----------

Conclusion

The observation of study strongly suggested that hardness and TDS of sample water is very high and needs to be lowered down before use. By boiling the water hardness can be lowered down. Effect of calcium on muscle cell membrane causes muscle weakness and depressive effect also developed when more than 12 per cent calcium is present in the blood. When calcium level rises more than 17 percent calcium phosphate is likely to precipitate throughout the body giving rise to parathyroid poisoning. Magnesium is also present with calcium in water which may cause hardness of water so that soap does not creates foam so that large amount of soap is required which causes hair loss and greying of hairs[17].

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