Research Article

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Ground water quality assessment in and around Bhagwanpur industrial area (UK), India

Abstract

In order to assess the ground water and surface water quality, water samples were collected from different sources to analyse the physico-chemical parameters and some heavy metals. However the study shows that the water pollution in Bhagwanpur industrial development areas has significantly reduced, due to fact that the effluents are treated regularly for the last few years. This makes the groundwater quality in the catchments area of study is found to be severely to moderately polluted in respect of heavy metal concentration. As per the study, the water quality is not very good for human consumption.

Keywords: water analysis, hand pump water, heavy metals, consumption, freshwater

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Introduction

In the recent time, it is well known that what is the value or importance of freshwater to the all kind of animals, plant and human beings, because freshwater relates to their health. As Fresh water is naturally occurring water on the Earth's surface in ice sheets, ice caps, glaciers, icebergs, bogs, ponds, lakes, rivers and streams, and underground as groundwater in aquifers and underground streams. Fresh water is generally characterized by having low concentrations of dissolved salts and other total dissolved solids. As per U.S. Geological Survey, out of all the water on Earth, saline water in oceans, seas and saline groundwater make up about 97% of it. Only 2.5–2.75% is fresh water, including 1.75–2% frozen in glaciers, ice and snow, 0.5–0.75% as fresh groundwater and soil moisture, and less than 0.01% of it as surface water in lakes, swamps and rivers.

Groundwater is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with water is called the water table. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal, and industrial use by constructing and operating extraction wells.[1] Increased industrialization, urbanization and agricultural activities during the last few decades have deteriorated the surface water and groundwater quality.[2,3] Groundwater contamination can often have serious ill effects on human health. Water pollution is the contamination of water bodies such as lakes, rivers, oceans, and groundwater. It occurs when pollutants are discharged directly or indirectly into water bodies without adequate treatment to remove harmful constituents.

Water pollution is a major problem in the global context. It has been suggested that it is the leading worldwide cause of deaths and diseases and that it accounts for the deaths of more than 14,000 people daily. Water for rural supply is mainly withdrawn from underground sources.[4] Development of the city has been accompanied by increased waste production and discharge with progressively more serious groundwater pollution. All the major industries play an important role in state economy and contribute to country's economy. Some other developmental economic activities are also related to Pharmaceutical industry, like cooperative dairies, paper mills and poultry farms, in their respective regions. In spite of the fact that pharmaceutical industry is very important for economy, the need has arisen to review and recognize environmental problems related to it. The rapid increase industrialization leads to increase in urbanization and population, hence the degradation of air, water and soil quality. The effluents of these industries gave a great deal of influence on the pollution of the water bodies, these effluents can alter the physical, chemical and biological nature of the receiving water body.[5,6] The objective of this study is to evaluate the ground water quality of selected area especially focusing on heavy metal concentrations in ground water samples collected from drinking water sorces (Hand Pumps of different depth) at different locations

Material and methods

Study area

Bhagwanpur is a town in Bhagwanpur Mandal, Haridwar district in the state of Uttarakhand, India. It is 47 km far from Dehradun which is the capital of Uttarakhand. As of 2011 India census, Bhagwanpur had a population of 274586. Males constitute 52% of the population and females 48%. Bhagwanpur has an average literacy rate of 67.76%, higher than the national average of 59.5%; with male literacy of 76.82% and female literacy of 58.05%. Water samples were taken from hand pump of Bhagwanpur village near industrial area.

Sample collection

Water samples were collected during January 2016 for the analysis of the physio- chemical parameters. Water samples were collected from different sources at varying interval in thoroughly washed and sterilized bottle. Physico-Chemical analysis was done within 48 hours and the sample stored at room temperature. A kit containing sample collection bottles, standard chemical reagents, glassware, pH meter, thermometer and other accessories was used for sampling. Samples were collected fortnightly throughout the study period in morning hours

(7 A. M.-10A.M). Water was collected after discarding the stagnant water where as it was after sufficient wastages from hand pump. The water samples collected from different sources were analysed in the laboratory with the procedure as recommended by standard method of examination and wastewater.[7] The analysis was carried out for various physicochemical parameters such as temperature, pH, TS, TDS, TSS, Temperature, Alkalinity and Hardness. Some expected heavy metals such as, Fe, Ni, Cu, Zn, Cr and Mn also analysed.

Result and discussion

The observations for selected physico-chemical parameters are given in Table 1, while for heavy metals are depicted in Table 2. pH was recorded between the range of 6.90 of deep hand pump and 6.60 of shallow hand pump. Total Suspended Solid was recorded between the ranges of 190mg/l of deep hand pump and 230mg/l of shallow hand pump. In water, total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium, sodium, potassium and manganese, organic matter, salt and other particles. Groundwater with a TDS values less than 500mg/L can be considered as excellent for drinking purpose.[8] Total dissolved Solid was recorded between the ranges of 680mg/l of deep hand pump and 1010mg/l of shallow hand pump. Total alkalinity was recorded between the ranges of 310mg/l deep hand pump and

510mg/l of shallow hand pump. Total Hardness was recorded between the ranges of 260mg/l of deep hand pump and 360mg/l of shallow hand pump. Total Iron was recorded between the range of 0.05mg/l Deep Hand Pump and 0.08mg/l Shallow Hand Pump. Nickel was Not Detected both sampling location Deep & Shallow Hand pump. Copper was recorded not detected in Deep Hand Pump and 0.01mg/l in Shallow Hand Pump. Zinc was recorded 0.7mg/l in Deep Hand Pump and 0.9mg/l in Shallow Hand Pump. Chromium was recorded Not Detected Deep & Shallow Hand Pump. Manganese was recorded 0.04mg/l in Deep Hand Pump and 0.06mg/l in Shallow Hand Pump. In an aquatic ecosystem, certain heavy metals have strong relationship with some physico-chemical parameters and can get influenced by the alteration in the concentration of these parameters.[9,10] A few heavy metals are essential for plants and human body hence must be present in trace quantity either in our diet or anywhere in our food chain. Iron, Zinc, copper are the example of such type of beneficial metals. The high amount of these beneficial metals may be harmful in several ways and create many diseases. Different bodies set standards for these metals, beyond that the concentration may be harmful to living organisms.[11,12] The toxic heavy metals like chromium and nickel are not present in the collected water samples. Hence, the ground water of the area is quite safe for drinking purposes.

Table 1 Average of physico- chemical analysis in ground water

Parameters	Deep hand pump	Shallow hand pump
pH	6.9	6.6
Total solids, mg/l	870	1240
Total dissolved solids, mg/l	680	1010
Total suspended solids, mg/l	190	230
Temperature,°C	20.8	20.7
Alkalinity, mg/l	310	510
Hardness, mg/l	260	360

Table 2 Average of heavy metals in ground water

Parameters	Deep hand pump	Shallow hand pump
Iron as (Fe)mg/l	0.05mg/l	0.08mg/l
Nickel as (Ni)mg/l	ND	ND
Copper as (Cu)mg/l	ND	0.01mg/l
Zinc as (Zn)mg/l	0.7mg/l	0.9mg/l
Chromium as (Cr)mg/l	ND	ND
Manganese as (Mn)mg/l	0.04mg/l	0.06mg/l

Conclusion

On the basis of above results, it may be concluded that the ground water of the Bhagwanpur Industrial area, Hardwar district is found to be severely to moderately polluted. But concentrations Heavy Metal was recorded under limits and some metals were not detected in the collected samples. People depended on the polluted water are prone to health hazards of polluted drinking water and water quality management in needed in the area. The present study indicates that there is an urgent requirement of awareness programme to draw the

attention towards this region for taking necessary steps to minimize the adverse impacts.

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Conflict of interest

The author declares no conflict of interest.

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