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Groundwater Quality Assessment In Industrial City Bhilai And Durg Chhattisgarh

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Abstract: *Now a days , Human activities are the main important factor which effects Ground water quality of any region. Subsurface and Surface disposal of sewage and industrial wastes along with Agricultural wastes, also play vital role in deterioration of ground water quality. From natural resources ground water is the purest form of water source and meets the overall demand of semi urban and rural people. The quality and quantity of ground water are directly affected by the Urbanization and the unregulated growth of the population, because it alters the local topography and drainage system directly.*

In the areas like industrial city Bhilai and Durg , Shivnath river is the main source of surface water .Ground water is also another major source of water in this region. The quality of ground water varies from place to place, with the depth of water table, and from season to season and is primarily governed by the extent and composition of dissolved solids present in it. Contamination and overexploitation are the major cause of ground water quality problems. It is very difficult to detect and resolve ground water problem in any region.

Ground water samples were collected from various ground water sources. The sample collection area is mainly residential, industrial and near municipal waste dumps sites. In Bhilai, Range of TDS was observed in between 200-354 mg/l, whereas in Durg Range of TDS was observed in between 236-932mg/l. Bhilai city generating about 309 MT/day garbage and disposed in low lying areas as there is no proper disposal site. An average daily generation of municipal solid waste from the Durg city is about 180 MT and the waste is disposed at the trenching grounds.

As for as trace metals are concerned, cadmium , copper, chromium, and Lead were not found in any of the ground water sample of twin cities Bhilai and Durg. The concentration of manganese recorded a maximum level of 1.31mg/l. The presence of manganese above permissible limit of drinking water often imparts alien taste to water. In ground water iron generally occurs in two oxidation states, i.e., Ferrous (Fe2+) and Ferric (Fe3+) forms.

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I. Introduction

As all of us know ,the trace elements, contrary to most pollutants, are not biodegradable and undergo a global ecobiological cycle in which natural waters are the main pathways. The major sources of heavy metals in ground water include rock minerals, discharge of sewage and other waste effluents on land and runoff water. The water used for drinking purpose should be free from any toxic elements, living and nonliving organism and excessive amount of minerals that may be hazardous to health. (CPCB2010)

Some of the heavy metals are extremely essential to humans, for example, cobalt, copper, etc., but large quantities of them may cause physiological disorders. The cadmium, chromium and lead are highly toxic to humans even in low concentrations. The quality of ground water is of great importance in determining the suitability of particular ground water for a certain use (public water supply, irrigation, industrial applications, power generation etc.). The quality of ground water is the resultant of all the processes and reactions that have acted on the water from the moment it condensed in the atmosphere to the time it is discharged by a well. Therefore, the quality of ground water varies from place to place, with the depth of water table, and from season to season and is primarily governed by the extent and composition of dissolved solids present in it.

The present study was aimed to study the effect of groundwater quality due to rapid urbanization, industrialization and unscientific way of dumping of solid waste (municipal solid waste and industrial waste). Twin cities Bhilai and Durg were selected in the present study, are in a state of rapid urbanization and industrialization. In almost all towns/cities, the drinking water has been supplied through bore wells, hand pumps and in some cities river/lake water was being supplied.

To reduce the probability for volatilization or biodegradation between sampling and analysis , its necessary to keep samples as cool as possible without freezing. The objective of this study was the ground water quality assessment of twin cities Bhilai and Durg, Chhattisgarh where effluent from steel industry is discharged. Water samples were collected and analyzed for various physico-chemical characteristics. The results of the

analysis indicates significant variations in the ground water quality with respect to space and time. From analysis it is found that the trace elements like Cadmium, Chromium, , Lead, are not present in ground water samples exceeding the limits prescribed by WHO and other agencies.

II. Materials And Methods :

The study area is underlain by limestones of Chattisgarh Supergroup. Shales occur in small patches in NE and SW portions of the basin. A coarse textured drainage network drains the area. Some important Hydrological and Hydrogeological field investigations which are pre-requisites for understanding ground water pollution problems were carried out in the field. The ground water structures present in the area are dug wells, dug cum bore wells and bore wells.

III. Sampling Of Water Resources :

The ground water samples have been collected from pre-selected sites during pre-monsoon and post monsoon seasons. The preservation method recommended by Robert- Kerr Environmental Research Laboratory, Okhavhama were adopted while sampling of surface and ground waters.

Parameters like Temperature, Conductivity, and Total Dissolved solids were determined in each water sample in the field using portable analysis pit. The remaining parameters were determined using routine analytical techniques at Central Pollution Control Board Laboratory, New Delhi. The chemical analysis of surface and ground water includes pH, Conductance, TDS, Na, K, SO_4, NO_3, NO_2F, , Cd, Cr, Fe, Pb, These elements were determined by the methods given in the book standard methods for the examination of water and waste water (APHA-AWWA-WPCF, 1985) The ranges of values for major parameters are as given at the results and discussion.

It is important to know the geochemistry of the chemical-soil-groundwater interactions in order to assess the fate and impact of pollutant discharged on to the ground. Pollutants move through several different hydrologic zones as they migrate through the soil to the water table. A major problem in urbanized areas is the collection and disposal of domestic wastes. Because a large volume of sewage is generated in a small area, the waste cannot be adequately disposed off by conventional septic tanks and cesspools. The intensive use of natural resources and the large production of wastes in modern society often pose a threat to ground water quality and have already resulted in many incidents of ground water contamination. Pollutants are being added to the ground water system through human activities and natural processes. Solid waste from industrial units is being dumped near the factories, which is 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 contaminates the ground water.

The quality of ground water depends on a large number of individual hydrological, physical, chemical and biological factors. The water used for drinking purpose should be free from any toxic elements, living and nonliving organism and excessive amount of minerals that may be hazardous to health. Some of the heavy metals are extremely essential to humans, for example cobalt, copper, etc., but large quantities of them may cause physiological disorders.

IV. Discussion and Conclusion

After analysis of collected ground water samples from twin cities Bhilai and Durg, Follwing conclusions can be made regarding ground water quality-

A. In twin cities, the groundwater samples were found clear and odourless .
B. The groundwater was getting contaminated day by day due to percolation of stagnated sewage .
C. No proper under ground drainage system has been provided for smooth carrying of sewage from the cities to the disposal site. Open drainage with unlined drains provided in most of the cities. No separate drains were provided for storm water .
D. Continuous burning of Municipal Solid waste (MSW) was observed at Durg, Bhilai,
E. Foul smell and flies observed at municipal solid waste dumpsite. Segregation of Municipal Solid waste (MSW) was not done. All the waste was dumped combined. In some places solid waste has been dumped on the bank of Nallah.
F. The untreated or partially treated sewage is discharged in local drains leading to contamination of both surface and ground water.
G. The pH values in the ground water at twin cities Bhilai and Durg are mostly confined within the range 7.03 to 8.16. The pH values for most of the samples are well within the limits prescribed by WHO (1996) for various uses of water including drinking and other domestic supplies .
H. The measurement of electrical conductivity is directly related to the concentration of ionized substance in water and may also be related to problems of excessive hardness and/or other mineral contamination. The conductivity values in the ground water samples varied widely from 385 to 2470 μS/cm.

I. . The TDS values were found in between 195-16950 mg/l this might be due to the natural and percolation of industrial, Sewage & (Municipal Solid waste)MSW dump site wastewater in to the ground water table .

J. The concentration of chloride varies from 27 to 295 mg/L. More than 85% of the samples are within the desirable limit of 250 mg/L. None of the samples exceeded the maximum permissible limit of 1000 mg/L.

K. The concentration of sulphate in twin cities varied from 4.9 to 52mg/L. Bureau of Indian standard has prescribed 200 mg/L as the desirable limit and 400 mg/L as the permissible limit for sulphate in drinking water.

L. Nitrate content in drinking water is considered important for its adverse health effects. The occurrence of high levels of nitrate in ground water is a prominent problem in many parts of the country. The nitrate content in the monitored twin cities varied from 0.14 to 0.78mg/L.A limit of 45 mg/L has been prescribed by WHO and BIS for drinking water supplies. Its concentration above 45 mg/L may prove detriment to human health.

M. The concentration of sodium varied from 3.2to 73.9 mg/L.

N. The concentration of potassium in ground water varied from 0.6 to 3.75 mg/L Potassium is an essential element for humans, plants and animals and derived in food chain mainly from vegetation and soil. The main sources of potassium in ground water include rain water, weathering of potash silicate minerals, use of potash fertilizers and use of surface water for irrigation.

O. The water used for drinking purpose should be free from any toxic elements, living and nonliving organism and excessive amount of minerals that may be hazardous to health.

P. The concentration of manganese recorded a maximum level of 1.16mg/l. The presence of manganese above permissible limit of drinking water often imparts alien taste to water. It also has adverse effects on domestic uses and water supply structures. Manganese may gain entry into the body by inhalation, consumption of food and through drinking water.

Q. The copper, chromium, Lead, Cadmium, were not found any where in the ground water sample of twin cities .

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