



Comprising Analysis of Heavy Metals & Physicochemical properties in Ground Water of Northern Bastar Area of Chhattisgarh, India

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ABSTRACT

Ground water is a great supply of fresh water useful resource that is the largest troubles in front of the policy makers for its sustainable utilization. Quality of water is required to determine whether the ground water of a certain pleasant is appropriate for its intended use. Total 10 groundwater samples had been collected for monitoring reason. All the samples were analysed for various physical and chemical parameters in accordance to conventional strategies: this consists of pH, overall hardness, and total alkalinity, predominant cations which include Ca^{2+} , Mg^{2+} , and Fe^{2+} , major anion such as Cl^- , and heavy metals along with Cd, Cu, As, Pb. The consequences indicated that, very few parameters which include pH, hardness, alkalinity concentration within the groundwater samples are in the recommended most admissible limits authorized by way of WHO (international fitness corporation 940-949, 2002) and Bureau of Indian requirements (IS 10500:1991) consistent with the outcomes, the hardness contents between 80 and 550 mg/L as CaCO_3 . It became discovered that, the full hardness is especially correlated with the magnesium awareness than calcium in all samples. The variety of chlorides in all the places beneath research is 113.44-620.37 mg/L. It became determined that Cadmium, Lead and Nickel concentrations with in the guideline values so it could be concluded that groundwater first-rate within the look at vicinity, apart from a few cases, is appropriate for ingesting purposes with none unique treatment strategies. the present take a look at gives a complete popularity of groundwater pleasant for correct management within the area.

Keyword- Groundwater quality, physicochemical properties, Heavy metal analysis

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INTRODUCTION

With increase of population, rapid urbanization, land use transformation and modifications in way of life, "providing sufficient and safe water delivers to all" is increasingly becoming a project and the core plan for sustainable development and properly being of human societies. In the absence of clean water resources, groundwater is exploited to satisfy the demand exerted through diverse sectors. Groundwater occurs nearly everywhere beneath the earth surface now not best in a single aquifer, however additionally in hundreds of nearby aquifer structures. numerous elements consisting of weather, soil traits, flow of groundwater via rock types, topography, intrusion of ground water in coastal regions, human activities on the ground etc. pose numerous consequences on the quality of groundwater [11] [16]. The chemical composition of groundwater is a measure of its suitability as a source of water for human and animal consumption, irrigation, and for industrial and other functions [7]. Therefore, monitoring the purity of water is crucial because water is necessary for human fitness and the reliability of aquatic ecosystems.

Physicochemical parameters of groundwater are key factors for the evaluation of water quality. therefore, it's miles of great importance to analyses drinking water. Alongside the physicochemical properties, there are a few different alarming parameters for groundwater quality. The presence of toxic metals raised enormous issues in one of kind parts of the arena and effects mentioned by way of diverse companies have been alarming. "Heavy metals" is a collective time period which applies to the organization of the metals and metalloids with atomic density extra than 4 g/cm^3 [5][12].

MATERIAL AND METHODS

The primary sources of heavy metal pollution are agricultural runoff, sewage and discharges of untreated and semi treated effluents from steel-associated industries which include metal electroplating, production of batteries, circuit boards and automobile restore. road is likewise considered one of the largest resources of heavy metals [3]. There are numerous effects on human health due to presence of heavy metals in ingesting water. Consequently the heavy metals concentrations in consuming water have to be stored in low ppb (part in keeping with billion) variety.

An exploratory research inside the hydro geochemical characteristics of groundwater and thereby assesses the suitability of groundwater as an opportunity and dependable useful resource for public water deliver in the Indian town of Surat[14]. The consequences confirmed that pH, EC, water hardness, fluoride and sulphate degrees have been beneath the maximum permissible limit advocated by means of the WHO for drinking but chloride and nitrate stages in properly A6 have been above their respective WHO limits[1]

Hexavalent chromium constitutes a critical deterioration issue for the groundwater satisfactory of several regions around the arena. Excessive concentrations of this contaminant have been also reported in the groundwater of the Sarigkiol hydrological basin (close to Kozani town, NW Greece)[13].

Heavy metallic and metalloid (Cr, Pb, Cd, Zn, Cu, Ni, As and Hg) concentrations in groundwater from 19 typical sites all through an average brownfield have been detected by [3]. Imply concentrations of toxic metals in groundwater reduced inside the order of $Cr > Zn > Cu > Cd > Ni > Pb > Hg > As$. Attention of Cr^{6+} in groundwater turned into detected to similarly study chromium contamination. Cr^{6+} and Cd in groundwater have been advocated as the priority pollutants due to the fact they were usually 1399-fold and 12-fold greater than permissible limits, respectively. The dominant heavy metals found in potable water include iron, zinc, copper, chromium, lead, and manganese. The attention of heavy metals like mercury, lead, cadmium, iron, cobalt, manganese, chromium, nickel, zinc, and copper frequently exceed the most permissible restriction endorsed by using standard company of Nigeria and world health employer.[7]

The impact of the leachate from an open dumping web site in Ariyamangalam, Tiruchirappalli District, Tamil Nadu, on groundwater is investigated[9]. The results indicated that, very few parameters together with pH, sulfates and nitrates attention inside the groundwater samples are in the encouraged maximum admissible limits approved by WHO(global fitness agency Cd, Cu, Mn, Pb, and Zn. 940–949, 2002) and Bureau of Indian standards (IS 10500:1991). The heavy metal concentration status of groundwater in Brahmaputra flood simple Barpeta District, Assam, India invetigated by [5]. The existing work will help to be familiar with the suitability of groundwater for consuming applications as well as it will improve the database. Thane district is one of the maximum industrialized districts in Maharashtra. The location undertaken for the observe became Thane and its suburbans Kalwa, Divajunction, Dombivali, Kalyan, and Ulhasnagar. Groundwater samples and soil samples had been collected from residential, industrial, agriculture, and industrial areas. Groundwater samples had been analyzed for numerous water great parameters. The analytical facts shows very high concentration of overall dissolved solids, total hardness, general alkalinity, chemical oxygen call for, chloride and many others. [2].

Study area

Kanker District is situated in the southern region of the of Chhattisgarh, India in the longitudes 20.6-20.24 and latitudes 80.48-eighty one.48. The total area of district is 5285.01 square kilometres. The total population is 748,941. The floor water especially takes place in phreatic (water desk) situations and at places below semi-limited situations. Weathered formation thickness varies from 10 to 30 m. The floor water sources for Kanker district has been expected primarily based on the GEC.1997 technique. The internet annual is floor water availability is 83376.11 Ham. The gross annual draft has been predicted as 17349.seventy four Ham and out of which, the draft for irrigation is 15797.06 Ham and for home & commercial water deliver cause 1552.68.

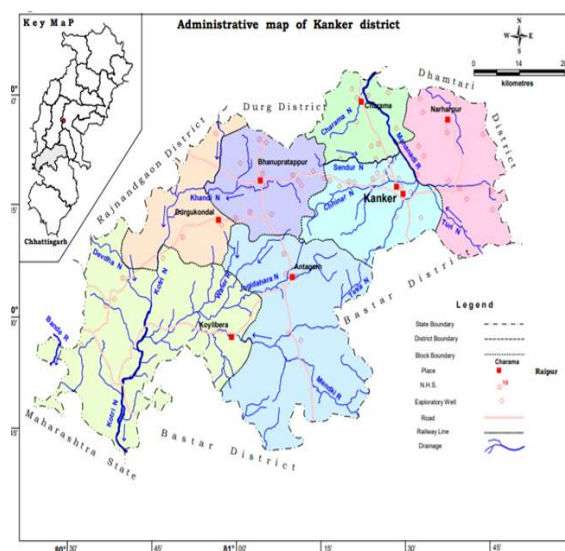


Fig. 1 Study area (Northern area of Bastar)

Sampling and analysis

For the analysis, 10 groundwater samples have been taken from rural drinking water wells. All samples were accrued in sterilized acid-washed polyethylene terephthalate (PET) bottles and straight away transported to the laboratory. Physicochemical parameters along with pH, electrical conductivity (EC), hardness, important cations (Ca^{2+} , Mg^{2+}) and essential anion, Cl^- had been measured primarily based on the standard strategies for the examination of water and wastewater in addition, heavy metals consisting of arsenic, chromium, copper, me cadmium, cobalt, iron, nickel, lead, antimony, were analysed through inductively coupled plasma optical emission spectrometry (ICPOES) and Atomic Absorption spectrometry method for the winter season samples. Heavy metal samples have been acidified using nitric acid and stored at 4°C until evaluation.



Fig: 2 Water samples collected from various locations

The groundwater of the studied vicinity is used for drinking and domestic functions. Table 1 shows the desirable and maximum permissible limit of individual species for drinking water recommended by using Bureau of Indian requirements (BIS). The physicochemical concentrations of collected groundwater samples for the diverse parameters are proven in Figs. 3. The pH values of all groundwater samples are inside the variety of BIS and WHO requirements.

RESULTS AND DISCUSSION

Physicochemical Analysis

The physicochemical parameters of groundwater samples, the BIS standards and WHO guiding principle values for drinking water are provided. As it may be visible in samples taken in the wintry weather season have decrease pH values (6.65-8.00).

From the measurements shown in Table 1, it's been showed that the chloride values in all samples had been below the guideline values. The range of chlorides in all the samples under investigation is 88.62 to 620.37 mg/L. Due to higher evaporation in summer time make the chloride to be concentrated in groundwater assets. Commonly, chloride ions in groundwater originate from chloride salts which can be water soluble determined in minerals. however, within the case of the observe place, anthropogenic assets including agricultural products (e.g. animal manure, fertilizer, and irrigation go back glide), oilfield

brine, household sewage, landfill leachate, business effluent, deicing salt, and pumping-brought about saltwater intrusion might be the opposite possibly resources of chloride in the water wells .

From the result any form of alkalinity became no longer observed in all ground water samples is consistent with the findings of other similar research. Carbonate and hydroxide alkalinity are found in alkaline water with pH values above 8.3. There may be a little facts about the health consequences of alkalinity in drinking water, however, use of alkaline water for washing causes skin problems.

Hardness is commonly expressed as the total concentration of calcium and magnesium in mg/L, equal of CaCO_3 . On the entire, total hardness is a parameter influencing the groundwater acceptability about the case of consuming purposes. Our effects show the hardness values among 80 to 550 mg/L. Only two groundwater samples (S2, S3) was moderately hard among 10 samples. The remaining groundwater samples have been very hard (greater than 180 mg/L as CaCO_3) in nature. As a result, hardness is strongly laid low with the geological shape which, derived in large part from the soil and rock formations. Hard water leads to the formation of scaling in pipeline, reduces the efficiency of water remedy strategies. Multivalent cations, mainly magnesium and calcium, are frequently present at a massive concentration in natural water. Cations that cause water hard are calcium and magnesium, the results of this study shows that magnesium contribution is extra than that of calcium. These ions are effortlessly prompted and especially react with cleaning soap to make it difficult to do away with scum. The consequences imply that the calcium concentration in groundwater samples have been in acceptable limit but for magnesium only two samples (S2, S7) had been the concentration is in appropriate limit. Overall, in view of the physicochemical quality of groundwater samples in this study, water is potable for drinking purpose.

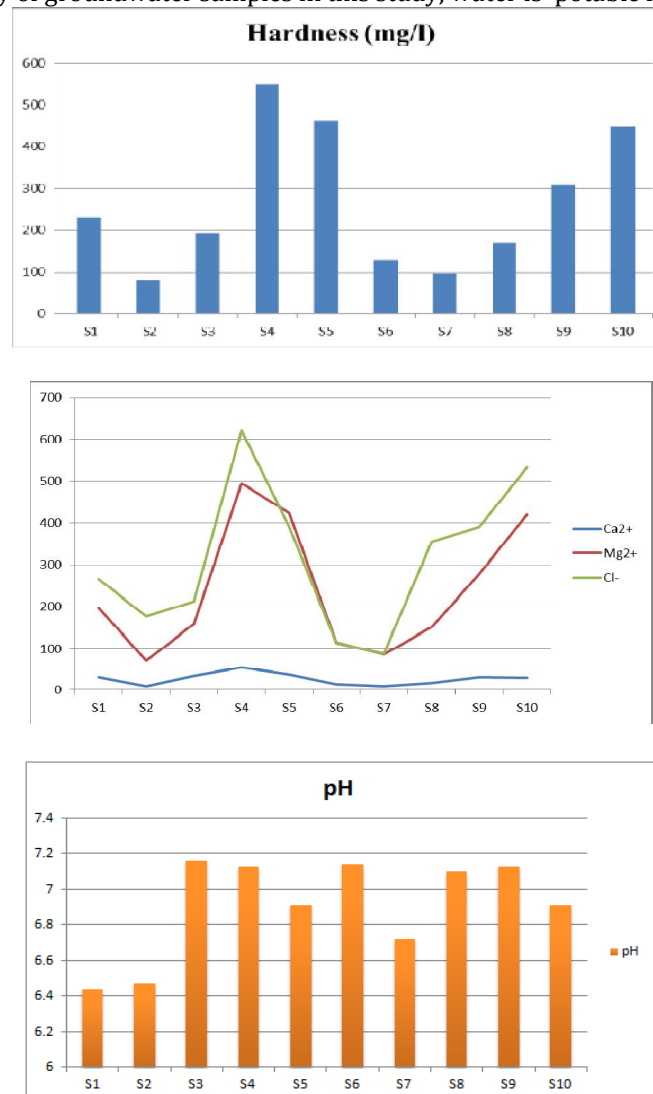


Fig. 3 Concentrations of pH, Total Hardness, Ca^{2+} , Mg^{2+} , and Cl^- (mg/l) in groundwater samples.

Sample	Hardness (mg/l)	Ca ²⁺ (mg/l)	Mg ²⁺ (mg/l)	Cl ⁻ (mg/l)	pH
S1	228	30.27	197.73	265.87	6.44
S2	80	8.41	71.59	177.25	6.47
S3	192	33.64	158.36	212.7	7.16
S4	548	53.82	494.18	620.37	7.13
S5	460	37	423	389.95	6.91
S6	128	13.45	114.55	113.44	7.14
S7	96	8.41	87.59	88.62	6.72
S8	168	16.82	151.18	354.5	7.1
S9	308	30.27	277.73	389.95	7.13
S10	448	28.59	419.41	531.75	6.91

Table1 :Water quality parameters of groundwater of study area

Heavy metals

Table 2.Gives the consequences of heavy metal evaluation while, some elements encompass, Cadmium, Cobalt, Iron and Arsenic have been non-detectable in all samples. However, contamination of groundwater with arsenic in other parts of the Northern Bastar area has previously been reported .

Chromium is found in natural deposits of ores containing different elements, ordinarily as chrome-iron ore. Anthropogenic sources of chromium as a contaminant within the surroundings are from the discharges of dye and paint pigments, timber preservatives, chrome-plating liquid wastes. clearly going on chromium can be associated with serpentine-containing rocks or chromium containing geologic formations inside the present study, all the collected samples comprise chromium levels much less than the guideline of drinking groundwater.

Pb accumulates inside the organs (i.e., mind), which may also lead to poisoning (plumbism) or even death. The gastrointestinal tract, kidneys, and vital nervous gadget are also stricken by the presence of lead. Youngsters exposed to steel are at risk for impaired development, lower IQ, shortened interest span, hyperactivity, and mental deterioration, with youngsters under the age of six being at extra sizable chance. Lead isn't a vital element. Lead can motive extreme harm to the brain, anxious machine, crimson blood cells, and kidneys. The threat of lead poisoning through the meals chain increases as the soil lead stage rises above this concentration. Our outcomes could be attributed to the fact that the awareness of lead in all samples was no longer beyond the applicable limit. From the analysis of collected samples the concentration of lead was not beyond the desirable limit.

Nickel is an element happens in surroundings most effective at very less amount and it's far crucial in small doses. While its tolerable quantity is handed it is risky .It causes diverse varieties of cancer on animals. The principle source of Ni contamination in water is metal plating industries, burning of fossil fuels, Mining of nickel and electroplating. Microorganisms can also suffer from growth decline due to the presence of Ni. Based on the end result concentration of Nickel of samples had been in suited limit.

Table2 : Heavy metal ion concentration of ground water samples

Sample	Cr	Pb	Cd	Ni	Co	As
S1	0.88	1.1	No detectable	0.33	No detectable	No detectable
S2	0.11	3.6	No detectable	0.46	No detectable	No detectable
S3	2.63	1	No detectable	0.42	No detectable	No detectable
S4	No detectable	1.1	No detectable	0.5	No detectable	No detectable
S5	0.47	1	No detectable	0.95	No detectable	No detectable
S6	0.38	0.8	No detectable	1.07	No detectable	No detectable
S7	No detectable	1.2	No detectable	0.81	No detectable	No detectable
S8	No detectable	0.9	No detectable	0.78	No detectable	No detectable
S9	No detectable	1.1	No detectable	0.66	No detectable	No detectable
S10	No detectable	0.8	No detectable	0.67	No detectable	No detectable

CONCLUSION

In the study area, total ten groundwater samples (from bore wells) had been drawn and analysed for their physicochemical parameters and heavy metals contents. The analytical effects of physicochemical properties have been as compared with the usual tenet values recommended via the WHO and BIS for consuming purposes. Similarly to physicochemical parameters, heavy metals of challenge (ten species) have been additionally measured in groundwater samples. The pH values of all groundwater samples are in the range of BIS and WHO requirements. The physicochemical evaluation indicated that chlorides (variety between 113.44 and 620.37 mg/L) and Hardness (ranges from 80 to 550 mg/L) of the groundwater samples are better than the permissible limits in all the sampling places while compared to different parameters. The presence of heavy metals (Pb, Cr and Ni) in groundwater samples and Iron, Arsenic, Cadmium was not detected. From the prevailing examine, it became determined that the groundwater is potable due to the fact maximum of the physicochemical parameters and heavy metals examined no longer exceed the permissible limits. It became also determined that overall hardness of groundwater is enormously dependent on magnesium concentration than calcium. The consequences of gift look at could be used to reliably make choice on drilling new wells or selecting present wells to deliver drinking water. Presented thematic maps are clarifying the general pleasant of groundwater within the look at area which might be reliable for decision making in drinking water sources choice.

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