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RESEARCH ARTICLE

HYDROGEOCHEMICAL INVESTIGATION OF GROUND WATER IN BADI OF RAISEN DISTRICT IN M.P.

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ABSTRACT

Over two thirds of Earth's surface is covered by water; less than a third is taken up by land. As Earth's population continues to grow, people are putting ever-increasing pressure on the planet's water resources. In a sense, our oceans, rivers, and other inland waters are being "squeezed" by human activities not so they take up less room, but so their quality is reduced (Anon, 1993). We know that pollution is a *human problem* because it is a relatively recent development in the planet's history: before the 19th century Industrial Revolution, people lived more in harmony with their immediate environment. As industrialization has spread around the globe, so the problem of pollution has spread with it. When Earth's population was much smaller, no one believed pollution would ever present a serious problem (Biswajit Raj, 2001). Today, with around 7 billion people on the planet, it has become apparent that there are limits. Pollution is one of the signs that humans have exceeded those limits. The pollution that passes directly into water from factories and cities can be reduced through treatment at source before it is discharged. It is harder to reduce the varied forms of pollution that are carried indirectly, by runoff, from a number of widely spread non-point sources, into freshwater (Handa, 1994). In general, it takes much longer to clean up polluted water bodies than for pollution to occur in the first place, and there is thus a need to focus on protecting (C.G.W.M. 1990) water resources. In many cases, clean-up takes more than 10 years. Although underground water is less easily polluted than water above ground, cleaning it once it is polluted takes longer and is more difficult and expensive. Ways are being found to assess where and how underground water is most vulnerable to pollution (Sampat, 2001). Ground water is less susceptible to bacterial pollution than surface water because the soil and rocks through which ground water flows screen out most of the bacteria. But freedom from bacterial pollution alone does not mean that the water is fit to drink. Many unseen dissolved mineral and organic constituents are present in ground water in various concentrations. Most are harmless or even beneficial; though occurring infrequently, others are harmful, and a few may be highly toxic (Chowdhury and Chandra, 1987; Heavy Metal Poisioning, 2016). Naturally occurring contaminants are present in the rocks and sediments. As groundwater flows through sediments, metals such as iron and manganese are dissolved and may later be found in high concentrations in the water. Industrial discharges, urban activities, agriculture, groundwater pumpage, and disposal of waste all can affect groundwater quality. Pesticides and fertilizers applied to crops can accumulate and migrate to the water table (Badmus, 2001). In recent years, the growth of industry, technology, population, and water use has increased the stress upon both our land and water resources. Locally, the quality of ground water has been degraded. Municipal and industrial wastes and chemical fertilizers, herbicides, and pesticides not properly contained have entered the soil, infiltrated some aquifers, and degraded the ground-water quality. Other pollution problems include sewer leakage, faulty septic-tank operation, and landfill leachates.

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INTRODUCTION

Groundwater is the water present beneath 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. The study of the distribution and movement of groundwater is hydrogeology, also called groundwater hydrology. Groundwater is often cheaper, more convenient and less vulnerable to pollution than surface water. Therefore, it is commonly used for public water supplies. Polluted groundwater is less visible, but more difficult to clean up, than pollution in rivers and lakes. Groundwater pollution most often results from improper disposal of wastes on land. Major sources include industrial and household chemicals and garbage landfills, excessive fertilizers and pesticides used in agriculture (Handa, 1983), industrial waste lagoons, tailings and process wastewater from mines, oil field brine pits, leaking underground oil storage tanks and pipelines, sewage sludge and septic systems. Water quality and quantity are intimately linked although not often measured simultaneously. Water quantity is often measured by means of remote hydrological monitoring stations which record water level, discharge, and velocity. Monitoring of water quantity can be undertaken, to a certain degree, with a minimal amount of

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human intervention, once a monitoring station has been set up. In contrast, water quality is usually determined by analysing samples of water. The Present investigation is intended to provide an overview of some ions present in ground water, quality monitoring data are used to illustrate key features of aquatic environments, and to demonstrate how human activities on the landscape can influence water quality in both positive and negative ways. Clear and concise background knowledge on water quality can serve to support other water assessments.

MATERIALS AND METHODS

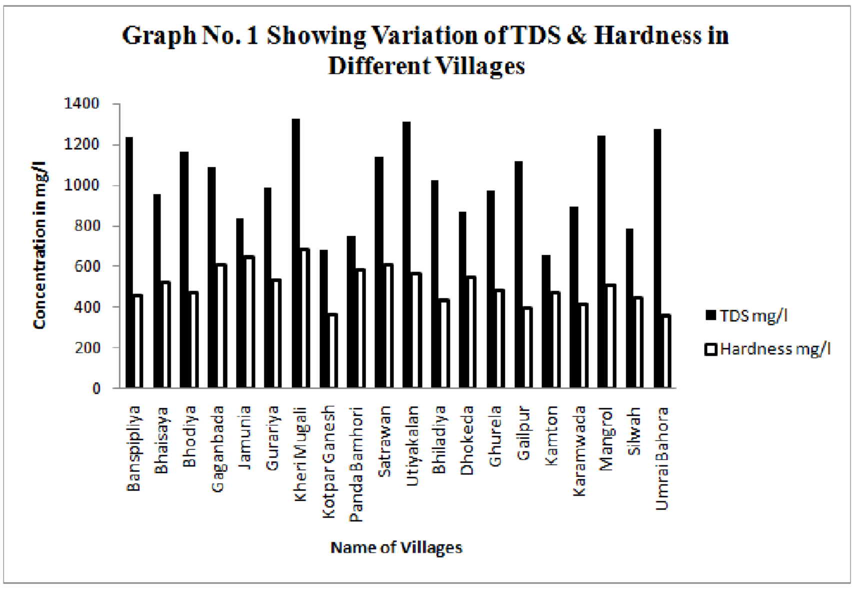
Twenty ground water samples were collected from twenty different villages of Badi Tehsil of Raisen District approximately 75km. from Bhopal, Madhya Pradesh. During sampling all the precautions were taken as per the standard guidance to avoid any possible contamination. The samples were collected from borewells which are extensively used for drinking and other domestic purposes. The collected ground water samples were analyzed for electrical conductivity using EC Meter. Total Hardness were analyzed titrimetrically using standard EDTA. All the ions are analyzed by A.A.S. The method of collection and analysis are essentially the same as given by APHA (A.P.H.A. 1998).

RESULTS AND DISCUSSION

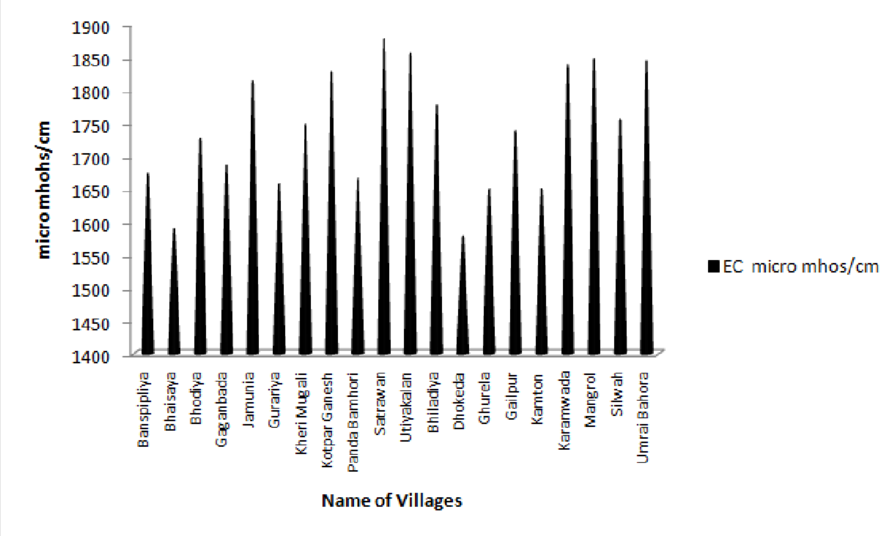
Table 1 shows the value of TDS obtained is in between 656 to 1325mg/l. It is observed that and is found ten samples below 1000 mg/l and ten samples has in between 1000-1500mg/l. The higher TDS causes gastrointestinal irritation to the human being which may lead to severe hazardous effect. Total Hardness is caused primarily by the presence of cation such as calcium and magnesium and anions such as chloride and sulphate in water. Water hardness has no adverse effect but very high value may cause kidney problem, more over it is unsuitable for domestic purpose. Ground water in the study area is exceeding the limit of 300mg/l. Fluoride concentration in this area is generally high. Small doses of fluoride have beneficial effect on the teeth by hardening the enamel, and reducing the increase of caries but excessive intake results in dental & skeletal fluorosis (Siddiqui, 1972). The maximum tolerance limit of fluoride in drinking water specified by the World Health Organization is 1.5mg/l. Fluorine is almost entirely derived from granite and pegmatitic rocks. There is no evidence of any addition of fluoride into the environment by artificial means either by industry or by any other sources. The factors that govern the distribution of fluoride in natural water are dependent on amount of fluorine in the source rocks and soils and the duration of contact of water with the rocks.

Table 1. Analytical data of physicochemical parameter in study area for some villages in badi of district raisen (M.P.)

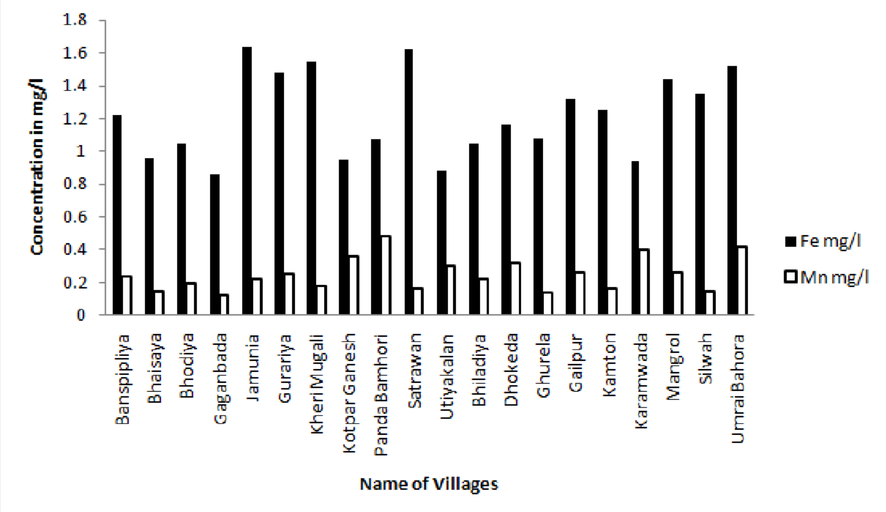
S. No.	Name of Villages	TDS mg/l	EC micro mhos/cm	Hardness mg/l	Fe mg/l	Mn mg/l	Cr mg/l	NO_3 mg/l	F mg/l
1.	Banspipliya	1235	1672	456	1.22	0.24	0.04	72	2.2
2.	Bhaisaya	955	1588	522	0.96	0.15	0.03	65	1.9
3.	Bhodiya	1164	1724	472	1.05	0.20	0.05	56	2.6
4.	Gaganbada	1085	1684	612	0.86	0.12	0.02	48	1.4
5.	Jamunia	834	1812	646	1.64	0.22	0.06	52	2.5
6.	Gurariya	986	1656	534	1.48	0.25	0.02	68	3.2
7.	Kheri Mugali	1325	1746	686	1.55	0.18	0.05	77	1.6
8.	Kotpar Ganesh	678	1826	364	0.95	0.36	0.03	82	2.8
9.	Panda Bamhori	746	1664	584	1.07	0.48	0.02	66	1.8
10.	Satrawan	1136	1876	608	1.62	0.16	0.04	74	2.4
11.	Utiyakalan	1312	1854	565	0.88	0.30	0.03	46	1.7
12.	Bhiladiya	1026	1775	436	1.05	0.22	0.02	54	2.3
13.	Dhokeda	866	1577	548	1.16	0.32	0.03	62	1.2
14.	Ghurela	972	1648	486	1.08	0.14	0.01	60	2.7
15.	Gailpur	1118	1736	396	1.32	0.26	0.02	50	1.9
16.	Kamton	656	1648	468	1.25	0.16	0.03	58	3.0
17.	Karamwada	894	1836	412	0.94	0.40	0.04	75	1.5
18.	Mangrol	1244	1845	508	1.44	0.26	0.05	60	1.7
19.	Silwah	786	1754	446	1.35	0.15	0.01	55	2.1
20.	Umrai Bahora	1272	1842	356	1.52	0.42	0.03	85	1.6



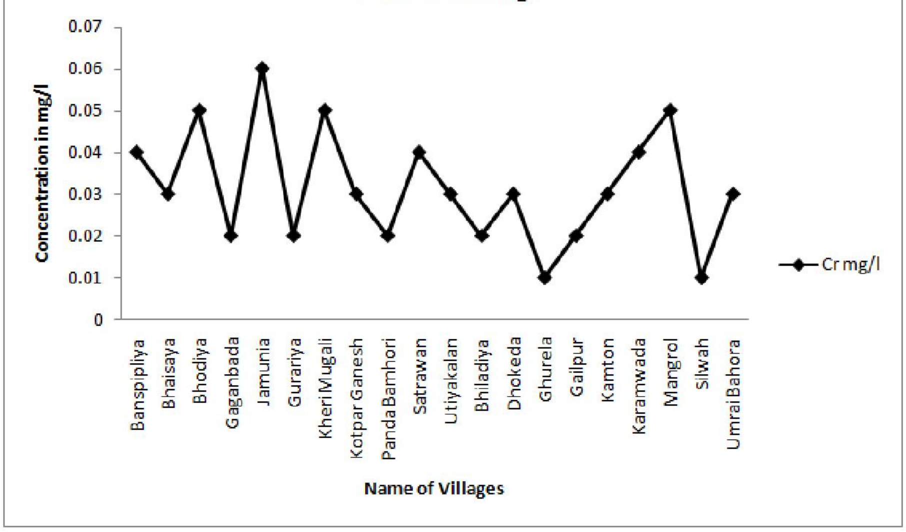
Graph No. 2 Showing Variation of Electrical Conductivity

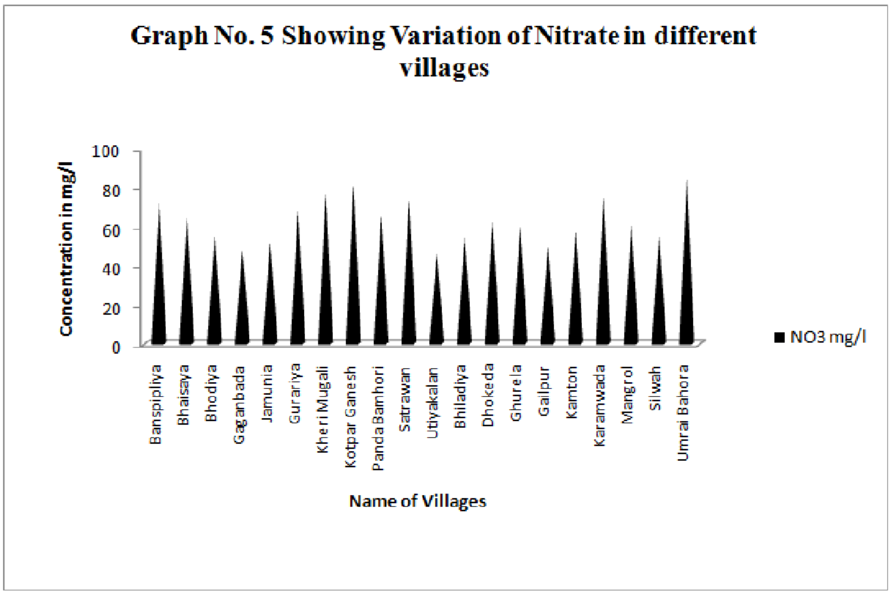


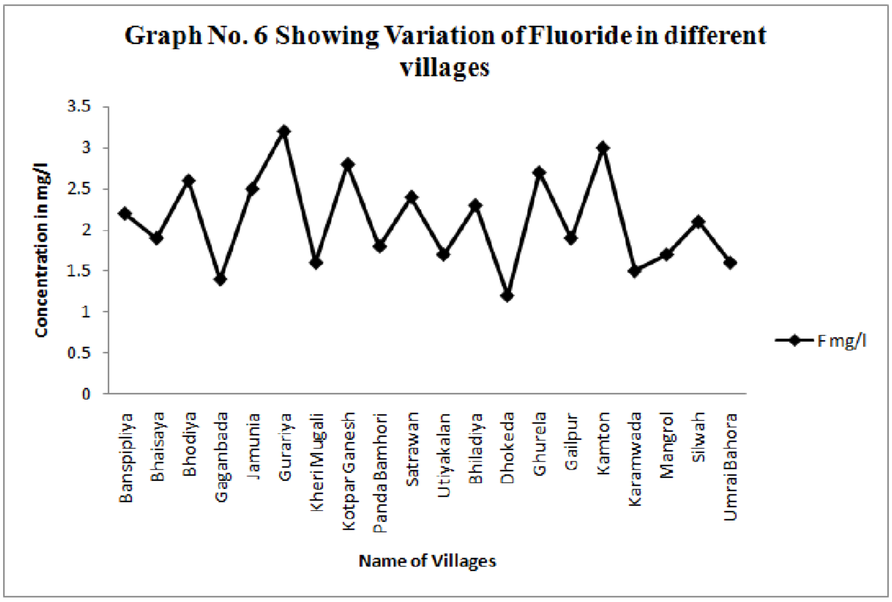
Graph No. 3 Showing Variation of Fe and Mn Concentration in different villages



Graph No. 4 Showing variation of Cr Concentration in different villages







The natural occurrence of high fluoride content in ground water is an environmental hazard (Czarnowski *et al*., 1999). The main source of fluoride in the groundwater is fluoride bearing rocks from which it get weathered and leached out contaminates the water. Fluorides occur in three forms, namely fluorspar or calcium fluoride (CaF_2) apatite or rock phosphate ($Ca_3F\ (PO_4)_3$ and cryolite (Na_3AIF_6). Concentration of fluorides is five times higher in granite than in basalt rock areas. Due to excessive use of fertilizer (Mehta *et al*., 1990) the nitrate concentration is high in groundwater in study area and found in between 46-85 mg/l. Nitrate contamination in groundwater poses serious health threat. Protection of groundwater from nitrate contamination is an often-overlooked health concern. Leaching of nitrate from agricultural land and from other sources to groundwater is a global phenomenon (Wakida, 206). Nitrates in drinking water is associated with a number of health problems (McCasland and Margaret, 2007) such as other gastrointestinal cancers, Methaemoglobinaemia, Alzheimer's disease. Vasculardementia, multiple sclerosis in human beings. Although Iron is an essential element in both plants and animals metabolism but higher value of Iron than permissible limit may cause health hazard (Finch and Mouson, 1972). Iron may be present as soluble ferrous or insoluble ferric form. Ground water Iron & Manganese are present in many types of rocks. Concentration of Iron and manganese in ground water are often higher than those measured in surface water. The most common sources of these elements in ground water are naturally occurring from weathering of iron and manganese bearing minerals and rocks. In study area most of samples are within permissible limit and not considered a health risk. Manganese (Mn) is very common in soils and sediment. It is commonly found with Iron as mineral oxide coatings on the surface of soil and rock grains. When ground water contacts these coatings the oxides are dissolved and may be transported in the ground water. Dissolved manganese is colourless. It is found in Water as Mn++ ions or as manganese bicarbonate. It is an essential element that is necessary for good health. If dissolved manganese is above .05mg/l which is found only in few cases, black or grey staining and a bitter metallic taste may result from oxidation of the water. There are several technologies for reducing the level of manganese in water. Chromite is an oxide minerals, composed of Iron and Chromium. $FeCr_2O_4$. It occurs in basic & ultrabasic igneous rocks and in the metamorphic and sedimentary rocks. In dissolved form it is present either as trivalent or hexavalent (National Research Council (U.S.). 1974*). In natural water trivalent chromium is most abundant.*

Conclusion

In surface water, such as rivers and lakes, dissolved iron is hardly ever found, because it reacts with oxygen, forms insoluble compounds and sinks out of the water. However, in ground water such as wells and springs, iron is the most common dissolved chemical. Although not considered to cause health problems in humans, its presence in potable water is rather unpleasant due to the bad odours it spreads, its rusty taste and colour, its feel on skin and hair, and its tendency to stain clothing. In addition, the presence of dissolved iron enhances the growth of iron bacteria, which forms dark-coloured slime layers on the inner side of a system's pipes. At the same time, iron is an essential nutrient for humans, with a recommended daily intake of 5 milligrams. Therefore, the official water and environment agencies in many countries have established a secondary limit for iron in drinking water, which is based on aesthetic concerns. Manganese is a mineral that naturally occurs in rocks and soil and may also be present due to underground pollution sources. Manganese is seldom found alone in a water supply. It is frequently found in iron-bearing waters but is more rare than iron. Chemically it can be considered a close relative of iron since it occurs in much the same forms as iron. In low concentrations it produces extremely objectionable stains on everything with which it comes in contact. High exposure to manganese has been associated with toxicity to the nervous system (Crsosimo and Koller, 2007). In two three sites where iron and manganese concentration exceeds the permissible limit - Ion Exchange treatment or Oxidizing filters may be adopted. As it is known neither iron or manganese is toxic metal. Chromium is an essential micronutrient for animals and plants. In human being it is essential as it helps in metabolism of sugar, protein and facts at low concentration, but at higher concentration exhibit toxic effect (Barceloux, 1999), such as respiratory problems, skin complaints etc. It is carcinogenic at high concentration. In the present study the concentration of chromium is very low. Hence no adverse impact on health is observed. Fluoride contamination (Czarnowski *et al*., 1999; Lu *et al*., 2000) is totally natural and not andropogenic hence high fluoride containing water should be properly treated before use or the bore well should be sealed not to be used for drinking purpose. To overcome the problem of fluoride contamination various methods and techniques are developed / developing. Broadly these can be categorized based on their application for commercial level or home water filteration purpose. The methods employed (Chaturvedi *et al*., 1998) mainly for this purpose are - 1) By activated Alumina, 2) Reverse Osmosis, 3) Electrodialysis Reversal method. EDR is the most efficient method which can be improvised to make it useful and affordable to rural mars and general public. Clinical report indicate that adequate calcium intake associated with reduced risk of dental fluorosis. Vitamin C also safeguards against the risk. Nitrate generally occur in trace quantities in surface water but may attain high levels in some groundwater it is well known that the nitrogenous fertilizers are one of the important sources for ground water nitrate. Further nitrogenous material are rare in geological system, Nitrate is derived may be from agricultural areas due to leaching from nitrate fertilizers hence excessive and random use of fertilizer should be prohibited.

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