



ORIGINAL RESEARCH PAPER

Zoology

CONTAMINATION OF GROUNDWATER OF SAHARSA DISTRICT

KEY WORDS: contamination, groundwater

Goutam Kumar

Research Scholar, Dept. Of Zoology, Ranchi University, Saharsa, Bihar, India

Dr R. B. JHA*

Associate Prof. (Zoology), Retd. Principal, R M College, Saharsa
*Corresponding Author

ABSTRACT

Contaminants that may be encountered in urbanized environments include industrial effluent and manufacturing wastes E.g.: Hexachlorobenzene, HCB, leachate generated from landfills, stockpiles, cemeteries or contaminated soils, nutrients and salts from Sewage treatment plant (STP) and effluent from irrigation activities, hydrocarbons leaking from underground storage tanks (USTs), chemicals and microorganisms from leaking underground pipeline and sewers, fertilizers and pesticides, acidic waters.

INTRODUCTION

Groundwater is considered as dependable source of water for various uses and construed to be less vulnerable to quality (physical and bacteriological) deterioration because it is considered to be sealed in the envelop of vadose zone. However, as the civilization grew, population density increased, urbanisation and industrialisation invaded and organised farming expanded rapidly, the quality of water started getting affected. Ground water quality is also getting deteriorated in different parts of the world in various climatic and hydrogeologic environments. The possible pollutants in ground water are limitless; they may be physical, organic and inorganic chemical, biological and radiological. Complex and inter-related series of modifications of ground water quality is created by diverse human activities as well as due to altered rate and type of rock-water interaction. Considerable differences of opinion exist over the distinction between the terms "Pollution" and "Contamination". Todd 1980 has opined pollution as any degradation of natural quality while contamination is reserved for pollution that constitutes a hazard to human health. Freeze and Cherry (1979) expressed contaminants as solids introduced into hydrologic environment as a result of human activity regardless of whether or not, the concentrations reach levels that cause significant degradation of water quality, whereas the term pollution is reserved for situations where contaminant concentrations attain levels that are considered to be objectionable. When the principal source and cause of ground water quality deterioration are related to human activities like municipal, industrial and agricultural; the pollution/contamination is referred as anthropogenic. On the other hand, the term "geogenic pollution" or more frequently used "geogenic contamination" refers to naturally occurring elevated concentration of certain elements in ground water having negative health effect.

Geogenic contamination of ground water might emanate from geochemical characteristics of the aquifer material-high concentration of contaminant in rock matrix dissolved during rock-water interaction or occur due to environmental conditions, like array of climatic conditions, redox condition in aquifer, groundwater flow congestion which facilitate the contaminant to enter in an aqueous phase. It is also possible that change in sub surface environmental condition is triggered by anthropogenic activities.

MATERIALS AND METHODS

Physico-chemical parameters is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different physic-chemical parameters. Selection of parameters for testing of water is solely depends upon for what purpose going to use that water and what extent need of its quality and purity. Water does content different types of floating, dissolved, suspended as well as microbiological

impurities. Some physical test should be performed for testing of its physical appearance such as temperature, color, odour, pH, turbidity, TDS etc. While chemical tests should be performed for its BOD, COD, dissolved oxygen (DO), alkalinity, hardness and other characters. For obtaining more and more quality and purity water, it should be tested for its trace metal, heavy metal contents and organic i.e. pesticide residue. It is obvious that drinking water should pass these entire tests and it should contently require amount of mineral level. Due to very low concentration of heavy metal and organic pesticide impurities present in water it needs highly sophisticated analytical instruments and well-trained manpower. Following different physic-chemical parameters are tested regularly for monitoring quality of water.

Table 1: Different analytical water quality parameters used for testing of quality of water and their source of occurrence and potential health efforts with USEPA guidelines (P.N et al, 2012)

Sr. No	Parameter	Source of Occurrence	Potential Health Effect
01	Turbidity	Soil run off	Associated with various disease causing bacteria
02	Colour	Due to presence of dissolved materials	---
03	Odour	Due to biological degradation.	Bad odour unpleasant
04	Electrical conductivity	Due to different dissolved solids.	Conductivity due to ionizable ions. High conductivity increases corrosive nature
05	pH	pH is changed due to different dissolved gases and solids.	Affects mucous membrane; bitter taste; corrosion
06	Dissolved oxygen	Presence due to dissolved oxygen	D.O. corrodes water lines, boilers and heat exchangers, at low level marine animals cannot survive.
07	Total Hardness	Presence of calcium (Ca ²⁺) and magnesium (Mg ²⁺) ions in a water supply. It is expressed. Hardness minerals exist to some degree in every water supply.	Poor lathering with soap; deterioration of the quality of clothes; scale forming

08	Total Alkalinity	Due to dissolved gases (CO ²)	Embrittlement of boiler steel.
09	TDS	Presence all dissolved salts	Gastro-intestinal irritation; corrosion or incrustation
10	Calcium	Precipitate soaps, anionic	Interference in dyeing, textile and many more

Bacteriological Water Quality Parameters

Water bodies usually consist of a wide variety of microorganisms, some of which are pathogenic and some of which are not. Some of the non-pathogenic microorganisms may lead to problems in water supplies such as unpleasant taste and odour which may serve as indicator of safety. The principal concern for microbiological quality of water, however, is the potential of contamination by pathogens. Such pathogenic contaminants include bacteria, helminthes, protozoa and viruses and most of these organisms are derived from feces (Amita, 2011). Indicator organisms, usually bacteria, are practically used to analyze the microbiological quality of water. among such indicators the most commonly ones are thermotolerant (fecal) coliforms or E. coli. In addition to the above-mentioned indicators of bacteriological water quality, the broader groups of coliforms known as total coliforms are also used in monitoring program (Amira, 2011). As with sanitary inspection, data on microbiological water quality may be divided into a number of categories and the levels of contamination associated with each category should be selected based on local circumstances (WHO, 2008).

Table 2 : The bacterial diseases transmitted through drinking water (Joao P.S.Cabral, 2010)

Disease	Causal Bacterial Agent
Cholera	Vibrio cholera, serovarieties O1 and O139
Gastroenteritis caused by vibrios	Mainly Vibrio parahaemolyticus
Typhoid fever and other serious salmonellosis	Salmonella enteric subsp. Enteric serover Paratyphi Salmonella enteric subsp. Enteric serovar Typhi Salmonella enteric subsp. Enteric serovar Typhimurium
Bacillary dysentery or shigellosis	Shigella dysenteriae, shigella flexneri, shigella boydii shigella sonnei
Acute diarrheas and gastroenteritis	Escherichia coli, particularly serotypes such as O148, O157 and O124

RESULTS AND DISCUSSION

High values of total alkalinity viz 325 mg/L, were observed in water samples from hand pump at Md. Ziaul Rahman (Mukhiya) of Mirzapur village under kahara Block. Such waters may cause excessive encrustation in distribution pipes as these water samples have a positive saturation index. High values associated with water bodies seem apparently polluted. Waters with such high values of alkalinity are not fit for irrigation purposes. The limits of calcium and magnesium have been prescribed in the range 75-200 mg/L and 50-100 mg/L, respectively⁶. Calcium and magnesium contents in all the samples collected fall within the limits prescribed. Hardness does not have any ill impact on human health though some evidences have been reported to indicate its role in heart diseases. Hand pump water samples have fluoride contents below 1.0 mg/L whereas hand pump water at Mr. Rajeshwar Prasad of patwaha village under kahara Block have fluoride content 1.5mg/L. It is reported that dental fluorosis may occur in those cases where water contains fluoride more than 1.0 mg/L. The chloride content in the samples is in between 56 to 16 mg/L. Natural water contains low chloride. The findings indicate that all the samples have

chloride below the permissible limits viz 250 - 1000 mg/L of chloride in drinking water, prescribed by Indian Standard Index (I.S. 10500/1983)⁸. The highest values of nitrate viz 10 mg/L was noted in hand pump water at Shri Madhu Kant Jha of sileth village under Sour bazaar Block and nil nitrate was recorded in hand pump water of other villages. Nitrates generally owe their origin mainly to anthropogenic sources and as such high values are not expected. The higher values of nitrates in few water samples may be attributed to the garbage in the vicinity of water source and excessive use of nitrogenous fertilizer. Nitrate toxicity in human beings were reported and diagnosed as methemoglobinemia, this illness is generally confined to infants.

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