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Integrated study of ground water quality in Industrial areas of Comrawli Village, JAGDISHPUR, District AMETHI: A Case Study

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Abstract

The large scale industrialization apart from its benefits to the masses has also generated a large number of toxic substances in the form of effluent. These effluents contaminate Groundwater, which is the only resource for drinking and other purposes. In the present Paper attempt is made to understand the impact of various industries on ground water Quality of village Comrawli (Jagdishpur), district Sultanpur, U.P. Study was undertaken to evaluate physic-chemical parameters like pH, total hardness, total alkalinity,chloride, fluoride, zinc, copper, lead and iron. The results revealed that only chloride, fluoride lead and iron are present in slight high concentration than permissible limits and not fit for human consumption without treatment.

Key words: Ground water, pH, Total hardness, Alkalinity, Chloride, Fluoride, Zinc, Copper, Lead, Comrawli village.

Introduction

Groundwater is an invisible natural resource and is present beneath our feet. Due to this hidden dimension, the general public is much less familiar with groundwater than more visible components of the water cycle, such as rain and surface water. It is the major source of drinking water in both urban and rural areas[1]. Ground water is the most important source of water supply for drinking, irrigation and industrial purposes[2]. Groundwater is used to meet 23% of all irrigation demands, to feed 53% of all public water supplies and to cover 97% of all rural domestic water demands. The large scale industrialization apart from its benefits to the masses has also generated a large number of toxic substances in the form of effluent[3],[4]. These

effluents contaminate groundwater, which is the only resource drinking and other purposes, once water is contaminated it becomes next to impossible to restore it back to its original status and it may remain in an unstable or even hazardous condition for decade or centuries[5]. Hence the monitoring of the quality of groundwater of these areas is the need of the day. Various studies carried out in the past have reported the impact of various industries on ground water quality[2-6]. In the present study the Village-Comrawli (Jagdishpur), Distt.-Sultanpur is chosen for present study due to presence of Indogulf, B.H.E.L., Malvica and Marva cement industries. All these industries effluents contain numerous highly harmful constituents which deteriorates the quality of groundwater in the nearby areas.

Materials and Methods

Water samples from the hand pumps, tube wells, wells depending upon availability have been collected from sites of Comrawli. The sampling sites are pre monsoon 2011. The samples were collected in pre cleaned polythene bottles with necessary precautions. Three samples were collected from each site at a time. That is total sixteen samples were taken. All the values of three samples are approximately same. Out of three samples the two same values were quoted. The temperature was measured on site with mercury thermometer. Standard methods[9] were followed for the estimation of total hardness, alkalinity, chloride, fluoride, lead, iron, zinc and copper. The results have been shown in Table-2.

Results and Discussion

pH – The pH of water is an important indication of its quality and provides important information in many types of geochemical equilibrium solubility calculation. The pH of the groundwater in the steady area varied from 7.5 to 8.0. The observed pH values were within the prescribed limit of, BIS.

Total dissolved Solids (TDS):

Ground water moves and stays for a longer time in its flow path, increase in total dissolved concentrations of major ions normally occur. Higher TDS shows longer residence period of water .The main ions, contributing to TDS are bicarbonate, carbonate, chloride, sulphate, nitrate, sodium, calcium and magnesium. The TDS of the groundwater varied from 200-605 ppm , some samples were found to be above the maximum permissible limit of BIS.

Total Hardness :

The hardness of water is related with production of leather from soap. It is primarily expressed by the sum of calcium and magnesium ions expressed as calcium carbonate. Other substances such as iron, aluminum may also contribute to a very small extent. The water hardness is primarily due to the result of interaction between water and geological formations. Total hardness varied from 175-358 ppm in the groundwater, which were found within desirable limit. Several investigators have reported that there are lesser cardio-vascular diseases in the areas of hard water[10].

Total Alkalinity :

The alkalinity in water is due to the presence of hydroxyl, carbonate and bicarbonate

ions. The alkalinity in the study area ranged from 231.8 -542.8 ppm, which is under permissible limits. High alkalinity values are indicative of the eutropic nature of the water body.

Fluoride :

Fluorides are necessary for men and animals in minute quantities because fluorine is a component of bones and teeth. Fluorine deficiency causes dental caries by inhibition of glycolysis and excess intake causes fluorosis. The beneficial effects of fluorine to human health, when present in optimal level and harmful effects at high level are well known. It has been reported that the bone strength and risk of bone fracture depend on the total intake if fluoride from all sources. In the treated groundwater samples the fluoride concentration varied from 0.7-1.9 ppm. The fluoride level should not exceed 1.0ppm as per BIS norms. Fluoride ion concentration is higher in the sites of RS-1, RS-4, RS-5 and RS-6 (table-3). 16.66% of the collected test samples show fluoride ion concentration above permissible limits.

Chloride :

Chloride is one of the most common element presents in natural water. The excess sodium and chloride in drinking water may cause heart failure. The permissible limit of chloride ion in drinking water is 250 ppm. The tolerance levels of chloride vary with climate and excretions. The chloride ion concentration in the study area ranged from 53-350 ppm. 33.33% of the collected test samples show higher chloride ion concentration than desirable limits. In the present study chloride content is found to be higher due to the presence of cement factories (RS-4, RS-5).

Zinc :

Zinc is an essential and beneficial element for human bodies. However, concentrations above 5 ppm cause bitter taste and opalescence in alkaline water. Zinc accumulation in human body causes vomiting renal damage, cramp etc. It enters in the drinking water from the deterioration of galvanized iron. The zinc content in water samples varied from 0.19 - 0.81 ppm and hence water samples are free from zinc contamination except some sample.

Copper :

Copper is one of the essential elements for human, the adult daily requirement is about 2.0 mg. Excess copper in human body causes sporadic fever, coma and even death. The copper contents in water samples ranged from 0.017 -0.061 ppm. The water samples under study are free from copper hazard.

Iron :

Iron is essential for good health because it transports oxygen in our blood so it is not considered hazardous to human health in fact. In drinking water iron may be present as Fe^{+2} and Fe^{+3} and $Fe(OH)_3$ in suspend of filterable forms. It causes staining to clothes and imparts bitter taste. Excessive concentration of iron may cause problems like rapid increase in respiration, hypertension and drowsiness. The present recommended limit for iron in drinking water is 0.3 -1.0 ppm. The iron concentration in water samples under study ranged from 0.18 -1.59 ppm. Fifty percent of the collected test

samples show iron concentration above permissible limit. Iron concentration is higher near fertilizer, cement and textile industries (RS-1,RS-5,RS-6).

Lead :

Lead is a highly toxic metal that is harmful to human health. it is used in industries as an antiknocking agent in automobile fuel. Higher level of lead in the blood can cause kidney dysfunction and brain damage. Lead contamination due to PVC pipes is one the major contributing factor of ground water pollution in India. The lead (Pb) levels in study site locations were in the range of 0.02-0.08 ppm. Its concentration is higher near B.H.E.L. (RS-2) and Marva cement(RS-4). 33.33% samples show lead concentration above the desirable limits.

Table 1. selected place and source for sample collection

Site	Place	Source
RS-1	Indogulf Fertilizer Road No. 1	Hand pump
RS-2	B.H.E.L. from Road No. 2	Hand pump
RS-3	Malvica Cement from Main Road	Hand pump
RS-4	Marva Cement near Tea Shop Road No. 3 (Utelwa Village)	Hand pump
RS-5	Arif Cement behind the Factoty(Camrawli Village)	Hand pump
RS-6	Runecha Taxtile Road No. 4(Utelwa Village)	Hand pump

Table 2. Physico-chemical properties of selected area

Site	pH	Total Dissolved Solids (TDS)	Total Hardness	Total Alkalinity	Fluoride	Chloride	Zn	Fe	Pb	Cu
RS-1	7.7	200	179	345	1.1	53	0.19	1.21	0.02	0.017
RS-2	7.9	605	258	231.8	0.9	144	0.73	0.99	0.06	0.041
RS-3	8.1	410	322	382	0.7	238	0.54	0.18	ND	0.038
RS-4	8.0	215	175	298	1.4	350	0.63	0.74	0.08	0.061
RS-5	7.7	535	358	542.8	1.2	319	0.81	1.44	0.05	0.011
RS-6	7.4	325	219	283	1.9	186	0.79	1.59	ND	0.035

All values ppm except pH or where indicated, ND= Not Detectable i.e equal to 0.

Table 3. Ground water quality % Sample Compliance /Violation with respect to Standards at Jagdishpur Area of Amethi District, Uttar Pradesh (Year 2012)

YEAR-2012 (Pre-monsoon)			Standard BIS		% Sample Compliance/ Violation	Location sites showing violation
S.No.	Parameters	Range	Desirable (DL)	Permi-ssible (PL)		
1	**Fluoride**	**0.7-1.9**	**1.0**	**1.5**	**16.66% of the collected test samples show values above the PL and 50% above the DL and rest of the samples show values within the DL i.e. about 33.33%**	Runecha Taxtile Road No. 4 (Utelwa Village), Indogulf Fertilizer Road No. 1, Marva Cement near Tea Shop Road No. 3(Utelwa Village), Arif Cement behind the Factoty (Camrawli Village)
2	**Chloride**	**53-350**	**250**	**1000**	**33.33% of the collected test samples show values above the DL and rest of the samples show values within the PL i.e. about 66.66%**	Malvica Cement from Main Road, Marva Cement near Tea Shop Road No. 3(Utelwa Village), Arif Cement behind the Factoty (Camrawli Village)
3	**Iron**	**0.18-1.59**	**0.3**	**1.0**	**50% of the collected test samples show values above the PL, 33.33% samples show values above the DL and rest of the samples i.e about 16.66% show values within the DL.**	Indogulf Fertilizer Road No. 1, Arif Cement behind the Factoty (Camrawli Village), Runecha Taxtile Road No. 4 (Utelwa Village)
4	**Lead**	**0.0-0.08**	**0.05**	**No Rela-xation**	**33.33% of the collected test samples show values above the DL and rest of the samples show values within the DL i.e. about 66.66%**	B.H.E.L. from Road No. 2, Marva Cement near Tea Shop Road No. 3 (Utelwa Village)

Conclusions

Ground water quality with respect to critical parameters such as chloride, fluoride and heavy metals like iron and lead have been found to be higher than the desirable values, which are discussed and their compliance/ violation against drinking water standards have been summarized in table 3. High level concentration of these ions in ground water indicated the unsuitability of this water for potable purposes and requires proper filtration process to the use for potable purposes.

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