GEOCHEMICAL STUDIES OF GROUND WATER IN AND AROUND KOVILUR DINDIGUL DUE TO THE IMPACT OF SEWAGE AND IRON INDUSTRY EFFLUENT

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ABSTRACT

The investigator has made an attempt to study the impact of untreated Iron Industry effluent in the groundwater sources located at kovilur. As the result the groundwater sources around different residential area like kovilur reaches high degree of pollution. Ground water analysis at four different sites at four directions reveals that the water quality parameters are higher than the permitted level. As per BIS standard specifically high turbidity, high TDS and higher Electrical conductivity values indicate that the water cannot be used for domestic purpose. The adjoining groundwater sources are mostly affected and the water becomes very salty with very high TDS. Hence the polluted water is suggested to water treatment using Reverse Osmosis System.

Keywords: Ground Water, Surface water, Iron Industry Effluent, Sewage, BIS Standard, Reverse Osmosis System.

1. INTRODUCTION

1.1. INDUSTRIAL EFFLUENT

The steel industry is one of the most important and vital Industry of the present and the future. It is the asset of a nation. Steel plants use a tremendous amount of water for waste transfer, cooling and dust control. The steel plants have sintering mills, coke plants, blast furnaces, chemical byproducts and chemical processes, water cooled rolls, pumps, extrusion experiment, transfer lines for sludges and slurries. All these plants use a tremendous amount of water to cool the products and flush the impurities away from the finished stock. (Sanjeev Kumar Sinha et al., 2014)

Wastewater is generated in huge quantity in steel industries. It contains many dissolved, undisclosed substances and chemicals in the wastewater. The steel industries produce wastewater and sludge during different industrial processes.

The development of innovative technologies for treatment of wastewaters from steel industries is a matter of alarming concern for us. Although many research papers have been reported on wastewater pollution control studies, but a very few research work is carried out for treatment of wastewater of steel industries, especially in reference to development of design of industrial effluent Treatment Plants (ETP) system. Another beneficial aspect of this research work will be recycling, reuse of water and sludge from steel industry. (Sanjeev Kumar Sinha et al., 2014)

Industrial wastes are usually generated from different industrial processes, as a result the amount and toxicity of waste released from industrial activities varies with the industrial processes. Again, among all the industrial wastes tannery effluents are ranked as the highest pollutants (Shen, 1999). It involves many physical, chemical, and biological processes that take place in a variety of physiographic and climatic settings. For many decades, studies of the interaction of ground water and surface water were directed primarily at large alluvial stream and aquifer systems (A.pandia rajan et al., 2014).

Effluent irrigation has been practiced for centuries throughout the world (Shiva et al., 1986; Tripathi et al., 2011). It provides farmers with a nutrient enriched water supply and society with a reliable and inexpensive system for wastewater treatment and disposal (Feigin et al., 1991). In India also being a cheap source of irrigation farmers are applying this water to their fields. Rapid industrialization, population explosion and more urbanization in India have created enormous problems of environmental pollution in terms of generating the variable quantity and quality of solid and liquid wastes. In developing countries, there has not been much emphasis on the installation of sewage treatment plants and all the tannery effluents are generally discharged into the sewage system. The sewage waters are used as potential source irrigation for raising vegetables and fodder crops around the sewage disposal sites which are directly or indirectly consumed by human beings.

Soil contamination by sewage and Iron industry effluents has affected adversely both soil health and crop productivity. Sewage and Iron industry effluents are the rich sources of both beneficial as well as harmful elements. Since some of these effluents are a rich source of plant nutrients, therefore soil provides the logical sink for their disposal. But much untreated and contaminated sewage and Iron industry effluents may have a high concentration of several heavy metals such Fe, Mn, and Cr (Arora et al., 1985).

Their continuous disposal on agricultural soils has resulted in soil sickness (Narwal et al., 1988) and accumulation of some of the toxic metals in soil (Adhikari et al., 1993; Antil 2005, Gupta et al. 2002, 1998; Kharche et al., 2011) which may pose serious human and animal health. Several studies have been carried out for the treatment of industrial effluents through coagulation and flocculation process (Shouli et al., 1992).

2. SCOPE AND OBJECTIVES OF THE STUDY

The volume of sewage and Iron Industry Effluents discharged is increasing day by day. The sewage water and the Iron Industry effluent from the foundry units discharge the polluted water into the pond without any treatment. The option of treatment plant to treat the sewage water and the Iron Industry effluent may lead to spoilage of environment.

2.1. OBJECTIVES

To assess the Physico-chemical parameters of the water in kovilur, Dindigul.

To evaluate the Physico- chemical parameter of the ground water present in the well and bore wells around kovilur, Dindigul.

To suggest suitable remedial measures to treat the groundwater using RO system.

3. MATERIALS AND METHODS

The River Santhanavarthini at kovilur has become a collection of sewage water and Iron Industry effluent from various units of foundry industries, Dindigul town. Hence the water in the River as well as the ground water sources in and around the River at a radius of 2 km is completely polluted due to the continuous discharge and percolations of the sewage water and Iron Industry effluents to the ground water.

An attempt has been made to analyse the extent of water pollution by analyzing various water quality parameters for four sites. The water sample was analysed and compared with the guideline of Bureau of Indian Standards (BIS) limit for drinking water standards. Analysis of Physico-chemical characteristics of water samples were undertaken to find the water quality.

Table 1: The Water Quality Parameters standard level for (WHO & BIS)

Parameters	WHO – standard			BIS - Standard	Method of Analysis
	UNITS	HDL	MPL		
PHYSICAL PARAMETERS					
Odour	Hazen Units (Hz)	Unobjectionable		Unobjectionable	Visual comparison
Turbidity NT units	NT unit	5	10	5	Neplo turbidity meter
Total dissolved solids	mg/L	500	2000	500	Conductivity method
Electrical conductivity	Micro mhos/cm	Nil	Nil	Nil	Conductivity meter
CHEMICAL PARAMETERS					
pH	P^H unit	6.5-8.5	No relaxation	7.0-8.5	pH Meter
Alkalinity total as CaCO3	mg/L	200	600	200	EDTA titrimetric method
Total hardness as CaCO3	mg/L	300	600	300	EDTA titrimetric method
Calcium as Ca	mg/L	75	200	75	EDTA titrimetric method
Magnesium as Mg	mg/L	30	150	30	Calculation from total hardness
Sodium as Na	mg/L	Nil	Nil	Nil	-
Potassium as K	mg/L	Nil	Nil	Nil	-
Iron as Fe	mg/L	0.3	1.0	0.1	Spectrophotometer
Manganese as Mn	mg/L	0.1	0.1	0.05	
Nitrite as NO_2	mg/L	Nil	Nil	Nil	Spectrophotometer
Nitrate as NO_3	mg/L	50	No relaxation	45	Spectrophotometer
Chloride as Cl	mg/L	250	1000	200	Silver nitrate
Fluoride as F	mg/L	1.0	1.5	0.05	Colorimetric meter

Table 2 : COMPREHENSIVE TABLE OF WATER QUALITY ANALYSIS

Sample collection	units	BIS Limit	S1	S2	S3	S4
Appearance	-	-	Turbid	Clear	Clear	Clear
Colour	Hazen Units (Hz)	5	Blackish	Colourless	Blackish	Colourless
Turbidity	NT unit	5	7	6	7	5
Total dissolved solids	mg/L	500	1609	1008	1904	843
Electrical conductivity	Micro mhos/cm	-	1772	1389	2529	1060
P^H	P^H unit	7.0-8.5	7.69	7.89	8.43	7.93
Total hardness as $CaCO_3$	mg/L	300	730	468	540	672
Calcium as Ca	mg/L	75	14	64	74	61
Magnesium as Mg	mg/L	30	92	26	37	29
Sodium as Na	mg/L	–	110	124	112	78
Iron as Fe	mg/L	0.1	2.61	1.52	1.59	0.86
Ammonia as NH_3	mg/L	–	4.44	1.29	1.76	0.59
Nitrate as NO_3	mg/L	45	15	13	6	5
Chloride as Cl	mg/L	250	520	156	374	162
Fluoride as F	mg/L	1	1.3	0.4	0.8	0.4
Sulphate as SO_4	mg/L	200	127	116	76	62
Phosphate as PO_4	mg/L	–	2.30	0.90	0.72	0.63

SW-SUFACE WATER, BW- BORE WATER, OW- OPEN WELL WATER.

4. RESULTS AND DISCUSSIONS

4.1. DRINKING WATER STANDARDS

Raw water quality and standards depend upon the use. The four main uses are municipal, industrial, agricultural and recreational (fish and wildlife). As water quality is degraded day by day, so, it becomes very important to set the drinking water standards for the safety of water of our limited resources. Different agencies have set environment standards for safe drinking water as Bureau of Indian Standards (BIS), World Health Organization (WHO 2007), and European Economic Community (EEC) etc.

Drinking water standards are regulation that Bureau of Indian Standards (BIS) set to control the level of contamination in the drinking water (DWAF 1996). Bureau of Indian Standard considers the inputs from several organization i.e. Central, State, Semi Government, Municipal Corporation, Public Health Organization, etc. throughout the standard setting process.

4.2. SENSITIVE PARAMETERS

Parameters like TDS, EC, hardness, Iron and fluoride are taken as sensitive parameters to indicate the water pollution by Iron industry effluent from different sources. It is observed that the values are higher compared the BIS Standards.

4.3.DISCUSSIONS

4.3.1.WATER QUALITY

The results of various water samples for the various Physico-chemical analysis from different sites in, the study area presented and discussed. The results obtained for pH of the water samples varies from minimum of 7.69 to maximum of 8.43. The results obtained for Total dissolved solids vary from minimum of all water samples showed higher TDS values of 1060 mg/L to maximum of 2529 mg/L. All water levels should be low. All water samples showed higher TDS values. The results obtained for the degree of hardness in water samples various from 468 mg/L to 730 mg/L during the study. The highest desirable limit prescribed by BIS (1991) is 250 mg/L for drinking purposes. The results obtained for Iron content of water ranged from 0.86mg/L to 2.61mg/L. The high range was found at river water sample. The results obtained for concentration of fluoride varies from 0.4 mg/L to 1.3mg/L. The excess of fluoride in water cause dental and skeletal fluorsis.

5. CONCLUSION

An attempt has been made to Study the impact of untreated sewage water and Iron Industry effluent in the ground water sources. The River has become a collection of sewage and Iron Industry effluent water. Hence the water in the River as well as the ground water sources around the different residential area like Kovilur, due to the high degree of pollution many sources has to be abandoned ground water analysis at four different sites at four directions reveals that the water quality parameters are higher than the permitted level. As per BIS standard specifically high turbidity high TDS and higher Electrical conductivity values indicate that the water cannot be used for human consumption or any other use. People have to depend only on municipal water sources from Athoor village. For other uses the groundwater can be treated using R O system. The adjoining groundwater sources are mostly affected and the water becomes very salty with very high TDS. Hence the polluted water is suggested to water treatment using Reverse Osmosis System.

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