INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume3, Issue1)
Available online at: www.ijariit.com

Impact of Iron and Steel Industry on Ground Water Quality of Tungabhadra River Water in Bellary District (India)

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Abstract— Bellary district has 25 % of India's Iron ore reserves and is well known for its rich iron and manganese ore reserves. Iron ore deposits in Bellary district are widespread and have been a backbone to industrial development in the region. The environmental impact of large scale mining activities includes soil erosion, formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater and surface water by chemicals from mining processes.In this paper, efforts have been made to assess the quality of Tunga - Bhadra river water extensive survey and laboratory analysis which would give the information about 'Impacts on reservoir water quality' due to the Iron and steel industry. Also an attempt has made for controlling the groundwater pollution, which would serve as a basis to evolve suitable management strategy for the District. Therefore there is a significant changes in values of different parameters of ground water sources indicate the influence of industrial wastes on ground water.

Keywords— Iron and Steel; TDS; Hospet; Tunga-Bhadra

I. INTRODUCTION

Steel is crucial to the development of any modern economy and is considered to be the backbone of the human civilization [1]. Iron and steel are the main constituents of many products used in everyday life. Production of steel comprises, mining of ores, preparation of raw materials, agglomeration of fines in sinter plant, feeding of burden to blast furnace, manufacturing of coke in coke ovens, conversion of pig iron to steel, During the process large amounts of emission (stack and fugitive) consisting of dust, gaseous pollutants like SOX, NOx etc are generated [2,3].. All these mentioned operations add to air, water, land and noise pollution [4-6].

The selected places of Bellary district has been identified as one of the major environmental hotspots of the state due to problems arising out of mining and associated industries. And also availability of water is a serious problem in Bellary district as the area falls under semi-arid to arid zone[7]. The scanty rainfall, frequent droughts and the over exploitation of groundwater has resulted in the depletion of ground water table , Out of the very little volume of groundwater and surface water left, is either contaminated by chemicals from mining processes and is causing environmental damage and affecting the health of the local population[8].

II. OBJECTIVE

To study the Impact of Iron and Steel industry on ground water quality of the Bellary district, which is monitored for a wide range of parameters viz; pH, conductivity, chlorides, fluorides, nitrate, sulphates, Total dissolved solids (TDS), chemical oxygen demand (COD), Biological oxygen demand BOD and traces of metals.

III. MATERIALS AND METHODS

A. *Description of Study area*

Three representative areas were selected for the present study covering a 5 km stretch of Tunga-Bhadra dam is near the town of Hospete (Bellary District) in Karnataka. It is considered a multipurpose dam. Its storage capacity is 135 Tmcft. Owing to siltation, the capacity has been reduced by about 30 Tmcft. If there are seasonal and late rains, the dam distributes the estimated quantity of 235 Tmcft. It is filled when water is let into the canals during the rainy season. Selected areas for this present study are listed in Table 1.

Table 1.

The Lists Of Areas Were Selected For This Present Study.

Sl. No.	Sites	Location
1	Station-1	Tungabhadra River Back water-up stream, Near Tollagate, Hospet
2	Station-2	Tungabhadra River Back water-downstream, primary water canal, Near Bridge
3	Station-3	Tungabhadra River Back water near Gunda Forest, Hospet

B. *Physico-chemical parameters*

Physico-chemical parameters were examined for selected three different places near the Tunga-Bhadra dam. The pH of the water sample was estimated using "Eutech Cybernetics" made pH scan meter. The pH meter was calibrated with buffer solution of pH 4, 7 and 9.2 prior to its use. The conductivity (µmhos/cm) of the water sample was estimated using "Eutech cybernetics" made conductivity meter and this instrument was calibrated prior to its use. Dissolved oxygen of the water is measured by using WTW Oxi 330 meter. Total dissolved salts were determined by filtering 100 ml of water and then evaporating it in pre-weighed crucibles. The change in weight was used to calculate the dissolved salts. The chemical oxygen demand (COD) was determined by titration method, using ferrous ammonia sulphate and ferroin as an indicator.

IV Results and Discussions

Table 2

Physio-Chemical Parameters Of Tunga-Bhadra River Water For Different Stations

Sl. No.	Parameters	Station-1	Station-2	Station-3
1	pH	8.5	8.1	7.9
2	Conductivity (µmhos/cm)	236	184	173
3	Total Dissolved Salts (mg/l)	160	140	120
4	Turbidity, NTU	18	16	52
5	T. Hardness as $CaCO_3$, (mg/l)	78	74	72
6	Calcium as Ca^{+2} (mg/l)	19.2	19.2	20
7	Magnesium as Mg^{+2} (mg/l)	7.3	7.3	5.3
8	Chlorides as Cl, (mg/l)	22	22	22
9	Sulphates as SO_4 (mg/l)	27.2	18	16
10	Nitrates as NO_3 (mg/l)	0.13	0.1	0.11
11	Flouride as F^{-1} (mg/l)	0.2	0.2	0.2
12	BOD	2.7	2.7	4.9
13	Alkalinity as $CaCO_3$, mg/l	70	60	54
14	Total Fe	0.79	0.2	11.3

From the results obtained in Table 2, the variation of pH showed declination from alkaline to neutral and their by leaning towards acidic range. This indicated the increments in H+ ions. This may be attributed to increased addition of mind waste which is normally acidic in nature. The pH values varied from 8.5 at station-1 to 7.9 at station-3.

The dissolved salts concentration was showing reverse trend when compared to pH as the station 3 was near to the inlet of the channel which used to bring the waste from industries nearby. Probably these waste contents are not completely dissolved. Hence the TDS content was found less at station-3. When compared to station-1, the turbidity of sample is found to be high at gunda forest region. When compared to the samples at back water (i.e. station-1). This variation is due to the settlement is found to be more at station-1 and hence the turbidity is varying by 300 percentage between station-1 and station-2.

The chloride and Fluoride concentrations remained fairly constant at all the stations and their values were found to be 22 & 0.2 respectively. Which is an indication the alkalinity and total hardness as caco3 showed same trend of results which is indication of their inter dependability and constituting related ions. The gradual decrease in hardness is found to be 6 % from station-1 to station-2 and percentage decrease remained to be fairly constant between 2nd and 3rd station. The iron concentration at station-2 was found to be well within the limits as specified by world Health organisation. However, the iron concentration at station 1 was about 0.79 mg / L, which is almost 2.2 times above the standards whereas the iron concentration near gunda forest was found to be

37.6 times above the standards. The reason for this may be attributed to unsettled/un dissolved iron fractions entering the water body since station-3 happens to be the mouth of entry of the iron carrying waste channel to the water body. Sulphate where high up to 27.2 mg/L at station-1 and this value lowered up to 16 at station 3. This is an indicative of secondary products formed due to decomposition and staging of water at station-1 for a fair period of time. The BOD at station 1 & 2 was 2.7 where as it was nearing twice its value at station-3. This was carrying untreated and unsettled waste fractions.

Conclusions

The present study was indicates that the iron and steel industry changes the physiochemical properties of the Tunga-Bhadra river water. Water turns slightly acidic from Station-1 to Station-2 and the chloride & Fluoride concentrations remained fairly constant at all the stations. And also alkalinity and total hardness as caco3 showed same trend of results which is indication of their inter dependability and constituting related ions.

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