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Assessment of Groundwater and Stream Water Quality in the Region of Mysore Sugar Industry (M.S.Co.,), Mandya

S. Kavana
Asst.Professor
Department of Civil Engineering
T John institute of Technology Bangalore.

Dr. G.P Shivashankara
Professor,
Department of Civil Engineering
P.E.S.College of Engineering Mandya

Abstract **- A systematic study has been carried out to assess the stream water and groundwater quality and the effect of industrial effluent on stream and groundwater quality in the region of Mysore Sugar Industry. The Hebbala stream receives effluent from industry. The effluents from the industry, stream and groundwater samples were analyzed for the physical, chemical and bacteriological test for the water quality parameters. The effluent from sugar industry have more concentration of EC, TDS, TS, BOD,COD and E-coli where as TS, COD and BOD exceeds the tolerance limit for discharging effluents into inland stream. Stream water concentration increases due discharging of industrial effluent. Subsurface of the bore wells are divided into three Unions. Union1 (<0.5Km), Union2 (<1.0Km) and Union3 (>1.5Km) from the stream. Total dissolved solids, Total alkalinity, Total hardness, calcium hardness, magnesium hardness, chloride, sulphate, iron were found high concentration in groundwater. Union1 of groundwater source shows they have high concentration of ions and bacteria it is polluted. This may be infiltration of polluted Hebbala stream water. As DO is decreasing, COD, BOD and E-coli concentration increases due to infiltration of polluted Hebbala stream water. Based on the investigation, Hebbala stream water are polluted by the industrial effluent and it is not fit for domestic purpose and groundwater quality is also polluted by the Hebbala stream water.**

Keywords : Industrial effluent, Hebbala stream water, roundwater, physicochemical characteristicts

I. INTRODUCTION

Water is one of the most indispensable resources and elixir of life[4]. Important source of water are surface source (lakes, pond, tank, river, sea, ocean), subsurface source (underground water) and atmosphere (water vapor, precipitation) Surface water is one of the important source contributing to well being of human civilization. Therefore rivers, stream, lakes, tank, and their watersheds are diminishing as a result of urbanization and industrialization as the population increase[1].

Water gets polluted due to contamination by foreign matter such as microorganisms, chemicals, industrial or other wastes or sewage. These matters deteriorate the quality of the water and render it unfit for its intended uses. Wastewater also written as waste water is any water that has been adversely affected in quality by anthropogenic influence. It comprises of liquid wastewater discharge by the domestic, residences, commercial properties, industry and/or agriculture and can encompasses a wide range of potential contaminant and concentration[2]. The objective of study is taken to assessment of groundwater and stream water quality in the region of Mysore Sugar Industry Mandya.

II. STUDY AREA

Mysore Sugar Company Ltd., is located in Mandya city, Mandya district, which is a part of 1.5 Km from Mandya, which is having residential area, where thousands of civilians spend their livelihood. Mysore Sugar Company Ltd., lies in between $12^0$32'1.51" North latitude and $76^0$54'1.51"East longitude and is engaged in sugarcane crushing of 5000 MT, Co-generation of 5 MW and Distillery of 35 KLD[5]. Mysore Sugar Industry located in the North Zone and continuous flow of industrial wastes and effluents to the stream. Hence, the soil gets contaminated and resulting in soil pollution and henceforth the groundwater pollution. The effluent from the industry receives the river Rapti (Nagendra et.al 2011)[3]. Fig1 shows location of the problematic sampling station in the study area of Mysore sugar industry region.

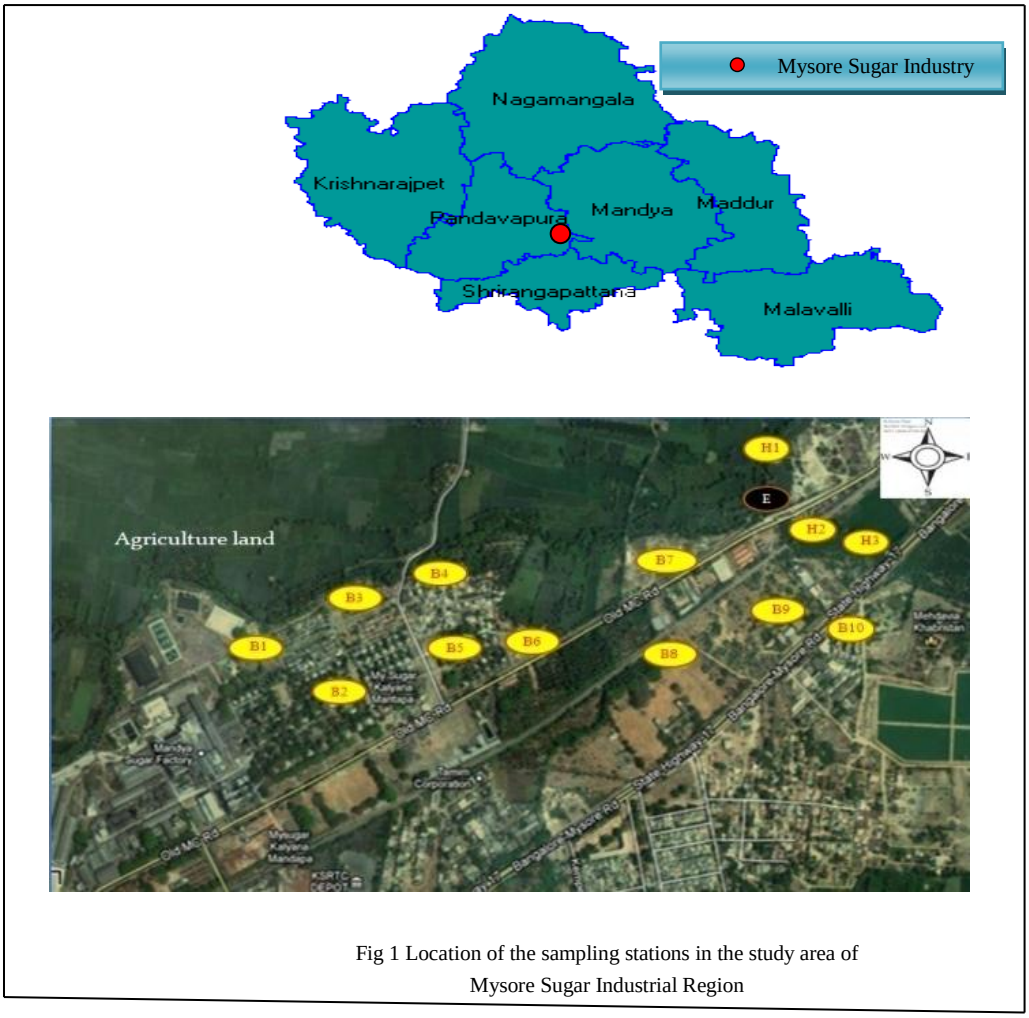

Fig 1 Location of the sampling stations in the study area of Mysore Sugar Industrial Region

III MATERIAL AND METHODOLOGY

Sampling programme, one sampling point from the effluent from the industry and three sampling point from the stream. The samples were collected and analyzed from Jan to March 2013.The samples of groundwater were collected from 10 sampling station and analyzed for the month of Jan to May 2013. About 2 liter of samples were collected in the sterilized polythene cans and they brought to P.E.S.C.E Environmental Engineering laboratory and analyzed for various physical, chemical and bacteriological test as per APHA standards method[6]. The analyzed data of groundwater were divided into three unions union1 (<0.5km), union2 (<1.0km) and union3 (>1.5km) from the stream.

IV. RESULTS AND DISCUSSIONS

Table 1 shows the characterization of effluent from the industry and Hebbala stream. Here E indicates effluents from the industry, H1 indicates before discharging Mysore Sugar Industrial wastewater, H2 indicates after discharging the Mysore Sugar wastewater, H3 indicates after the railway bridge.

Table 1: Characterization of effluent from the industry and Hebbala stream water quality analysis

Sampling point	pH	EC µS/cm	TDS mg/L	TH mg/L	TS mg/L	Cl^- mg/L	SO_4^{2-} mg/L	NO_3^- mg/L	PO_4^{3-} mg/L	E-coli No/100ml	DO mg/L	COD mg/L	BOD mg/L
H1	7.0	944	566	328	2048	178	107	11.92	0.60	93	0.03	1260	569
E	7.63	555	332	303	2032	121	72.9	10.75	0.62	72	1.67	717	373
H2	6.47	1633	979	340	2063	192	114	12.84	0.68	84	0.2	967	431
H3	6.33	1616	968	334	2142	164	98.4	13.37	0.71	75	0.3	859	376

E-represents effluent from the industry, H-represents Hebbala stream, 1 to 3-represents sampling points in the stream.

Table 2 :Bureau Of Indian Standards for Industrial Effluent (BIS 2490:1982)

Parameter	pH	TSmg/L	TDmg/l	Flioride,mg/l	BOD,mg/l	CODmg/l
Tolerence limit for industrial effluent discharged into inland surface water	5.5-9.0	100	2100	2	30	250

From the Table 1 depict variation of arithmetic mean value of various water quality parameter both effluent and Hebbala stream. Effluent from the sugar industry have more concentration EC, TDS, TS, E-coli, COD and BOD where as TS COD and BOD exceeds the tolerance limit of discharging effluent into inland stream[7]. DO is drastically decreasing which in turn COD, BOD and E-coli are also increasing. Stream water concentration increases due to discharging of industrial effluent from the Mysore Sugar Industry to the stream.

Impact of industrial effluent and polluted Hebbala stream on groundwater quality

For the study purposes, study area was divided into three unions. Union1 (B10, B9, B8, B7) which lies within 0.5 Km distance from the stream.Union2 (B6, B5, B4) which lies within 1Km. Union3 (B3, B2, B1) with lies more than 1.5Km from stream. From the Table 2 depicts the analysis of data in different unions. Fig 2 to 5 depicts the variation of water quality parameter with different unions.

In Union1, pH ranges from 7.68 to 7.70. In Union2, pH ranges from 7.48 to 8.22. In Union3, pH ranges from 7.41 to 7.57. The present study reported that all Union, of the pH value with the desirable limit. From the Table 2 depict analysis of data in different unions. In Union1, EC ranges from 1550 to 1845 µS/cm. In Union2, the EC ranges from 1474 to 1536 µS/cm. In Union3, the EC ranges from 1239 to 1443µS/cm. The present study indicates EC was within the desirable limit.

Fig 2 shows the comparative study of TDS with different unions. From the Table 2 depicts the analysis data in different unions. In Union1, TDS ranges from 934 to 1106 mg/L. In Union2, the TDS ranges from 640 to 928 mg/L. In Union3, the TDS ranges from 529 to 573 mg/L. The present study indicates Union1, TDS having maximum value when compared to Union2 and Union3 because due to dissolved solids are present in the groundwater due to influence of polluted Hebbala stream.

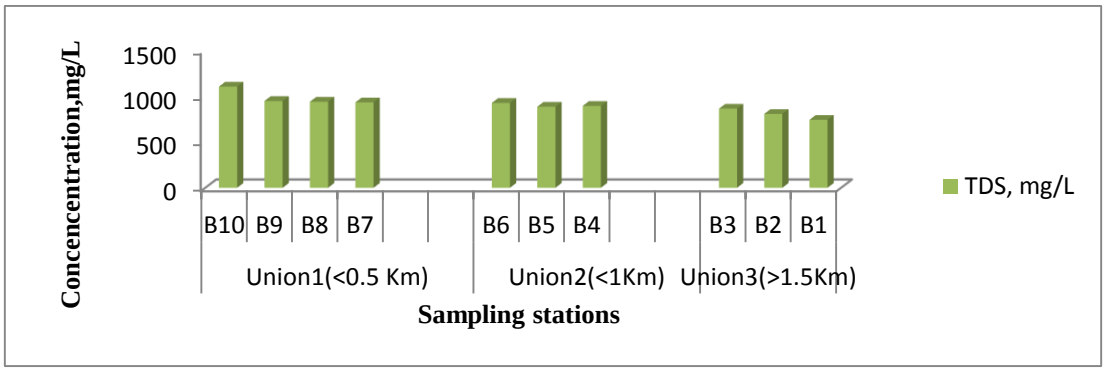

Fig 2 shows comparative study of TDS values at different unions (1, 2 and 3)

The Fig 3 shows the comparative study of total hardness, calcium and magnesium with the different unions. From the Table 2 depicts the analysis data in different Unions. In Union1, total hardness ranges from 676 to755 mg/L. Union2, total hardness ranges from 622 to 667mg/L.Union3, total hardness ranges from 529 to 573 mg/L.Union1, calcium ranges from 216 to 242 mg/L.Union2, calcium ranges from 198 to 213 mg/L.Union3, calcium ranges from 169 to 183 mg/L. In Union1, magnesium values ranges from 32 to 36 mg/L.Union2, magnesium values ranges from 30 to 31mg/L. In Union3, magnesium values ranges 25 to 28 mg/L. According to Basavaraj et .al[4] was reported that total hardness, calcium, magnesium are maximum due to percolation of

industrial effluent into bore well

The present study Union1, total hardness, calcium, magnesium value are Hebbala stream water have high concentration of calcium and magnesium it may impact on the ground water.

In Union1, total alkalinity, chloride, sulphate, is more when compared to Union2 and Union3. Total alkalinity, chloride, sulphate are more due to infiltration of polluted Hebbala stream water. According to Basavaraj et.al was reported that total alkalinity, chloride, sulphates are more due to industrial effluents are percolating into bore well. According to Basavaraju et.al[4]union1 is contaminated due to percolation of industrial wasteintoborewell

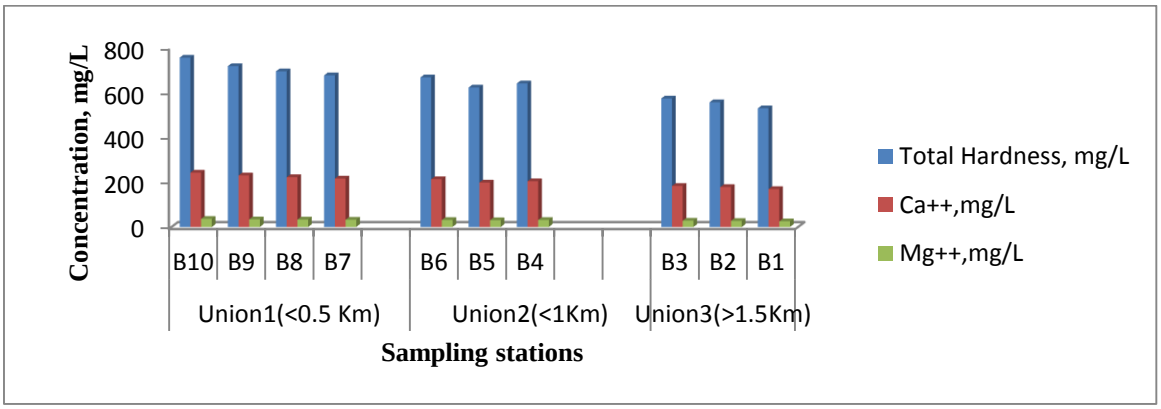

Fig 3 shows the comparative study of total hardness, calcium and magnesium values at different unions (1, 2 and 3)

From the Figure 4 shows the comparative study of E-coli with the different Unions. Table 3 depicts the variation of E-coli in different unions. In Union1, E-coli was maximum compared to Union2 and Union 3.In Union1,E-coli is more due to influence of polluted Hebbala stream.

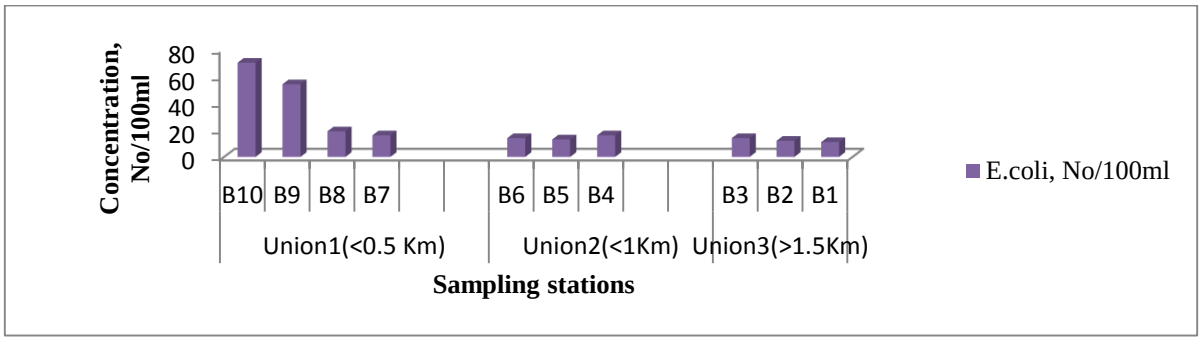

Fig 4 Shows comparative study of E-coli values at different unions (1, 2 and 3)

From the Figure 5 shows the comparative study of DO, COD and BOD with the different Unions. Table 2 depicts the variation of DO, COD and BOD at different Unions. In Union1, as DO is depleting there is an increase in the organic matter was more when compared to Union2 and Union3 this is due infiltration of polluted Hebbala stream water into groundwater through soil. According to Basavaraj et.al[4] also reported that DO is decreasing, and there is an increase in organic matter in bore well. Because of the percolating of industrial effluent into the bore well.

Table3: Investigation of Quality Assessment of Groundwater around Industry in Different Unions from the Hebbala stream

PARAMETER	IS10500:1991		Union1(<0.5 Km)				Union2(<1Km)			Union3(>1.5Km)		
	Desirable	Permisible	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1
pH	6.5-8.5	-	7.70	7.75	8.16	7.68	8.22	7.40	7.48	7.57	7.41	7.57
EC, µS/cm	2000	-	1845	1606	1569	1550	1536	1474	1500	1443	1346	1239
TDS, mg/L	500	1500	1106	949	941	934	928	886	895	865	807	743
Total Hardness, mg/L	300	600	755	717	694	676	667	622	640	573	556	529
Ca^{2+} Hardness, mg/L	150	-	604	573	555	540	533	497	512	458	445	423
Mg^{2+} Hardness, mg/L	75	-	151	144	139	136	134	125	128	115	111	105
Ca^{2+},mg/L	75	200	242	230	222	216	213	198	204	183	178	169
Mg^{2+},mg/L	30	100	36	34	33	32	31	30	31	28	27	25
HCO_3^- mg/L			143	136	131	128	126	118	121	109	105	100
Total Alkalinity, mg/L	200	400	678	643	622	608	598	558	574	516	500	476
Chloride, mg/L	250	1000	476	472	463	455	436	378	386	352	338	259
Sulphate, mg/L	200	400	286	283	279	273	263	227	232	211	203	155
Nitrate, mg/L	45	-	11.64	10.41	9.64	8.98	8.65	8.29	8.42	8.25	8.15	8.03
Orthophosphate, mg/L	5	5	0.17	0.13	0.11	0.09	0.07	0.05	0.06	0.04	0.03	0.02
Fluoride, mg/L	0.6-1.2	1.5	0.73	0.71	0.68	0.65	0.64	0.61	0.62	063	0.62	0.60
Iron, mg/L	0.3	1.0	0.57	0.54	0.52	0.50	0.48	0.45	0.47	0.43	0.41	0.36
E-coli, No/100ml	1	1	70	54	19	16	14	13	16	14	12	11
DO, mg/L	-	-	4.2	4.4	4.6	5.4	5.2	5.4	5.6	5.8	6.1	6.2
COD, mg/L	-	-	73.2	69.4	64.4	52.09	53.9	52.2	52.9	50.1	42.2	39.4
BOD, mg/L	-	-	7.51	7.28	7.03	5.16	6.17	6.42	5.81	5.66	4.79	4.67

B-represents bore well water

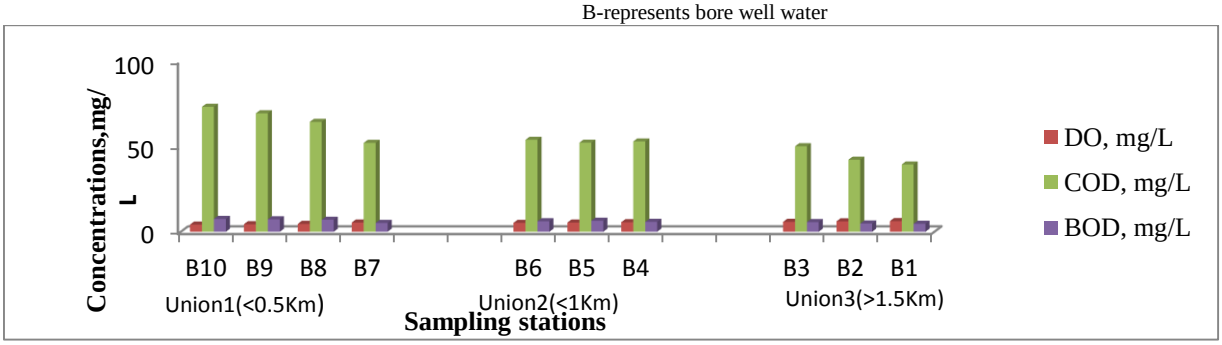

Fig 5 Shows comparative study of DO, COD and BOD values at different unions (1, 2 and 3)

Finally the study concluded that the total dissolved solids, total hardness, calcium, magnesium, total alkalinity, chloride, sulphate, iron were found high concentration in the groundwater. In Union1 of the groundwater source shows the high concentration of ions and bacteria and it is polluted. This is may be due to infiltration of polluted Hebbala stream. As DO is decreasing, COD, BOD and E-coli concentration increases due to infiltration of polluted Hebbala stream. These sources are not fit for drinking purpose.

V. CONCLUSIONS

Effluent from the industry have more concentration of EC, TDS, TS, COD, BOD and E-coli. The parameters like TS,COD and BOD exceed the tolerence limit of discharging effluent to the inland stream.Stream water concentration incresase due to discharging of industrial effluent.As DO in the stream is drastically depleting due to addition of industrial effluent and indicating is all most polluted the stream.Subsurface of the bore wells were divided into three unions. Union1 (<0.5Km), Union2 (<1Km) and Union3 (>1.5Km) from the stream. Union1 is more contaminated when compared to Union2 and Union3.These sources are not fit for drinking purpose. Based on the investigation stream water polluted by industrial effluent and it is not fit for domestic purpose and groundwater quality is all most polluted by the polluted Hebbala stream and it is not fit for drinking purpose.

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