



Studies of Physico-Chemical Parameter of River Belgirinalla, CG, INDIA

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Abstract

River Belgirinalla is a small tributary of river Hasdeo. River Hasdeo is the Life Line of Korba, Chhattisgarh. The present study was taken on River Belgirinalla. It is an important water source of village Parasabhatha and Belgiri Basti. This river is greatly influenced by effluents of industrial units and domestic wastes. There are major fly ashes, red muds and sewerage ponds situated near the River Belgirinalla, its overflow directly mixes with above mentioned river. The study revealed that the total solids, total dissolved solids, total suspended solids, ammonia, nitrite, phosphate and chemical oxygen demand of water of this area was higher than the limits. Biological oxygen demand was under the limit, DO was found lower than standard limits. The sediment of River Belgirinalla contains higher concentration of Pb^{2+} and Cd^{2+} than the permissible limit recommended by Indian Standards and World Health Organization. The present investigation highlights the adverse effect of surface water and sediment due to mixing of industrial and domestic wastes.

Keywords: River Belgirinalla, surface water, industrial effluents, sediment, Parasabhatha and Belgiri Basti.

Introduction

Korba is the power capital of state Chhattisgarh. It is situated on the banks of the confluence River Hasdeo, Ahiran, Belgirinalla and Dhengurnalla and located 22^o 01 to 23^o 01 latitude and 82^o 08 to 83^o 09 longitude. There are many Thermal power-generating units like National Thermal Power Corporation, Ltd. Jamnipali, Korba – 2100 MW, Balco Captive Power Plant, Pragati Nagar and VEDANTA Korba - 270 MW, Chhattisgarh State Electricity Board, East- Korba – 440 MW, Hasdeo Thermal Power Station, Chhattisgarh State Electricity Board, West- Korba – 840 MW etc., along with a major Aluminum smelting unit and other small-scale industries, they discharge their waste products in ponds or in water reservoir. These power-generating units are distributing on both sides of water bodies. There are three major fly ashes, red muds and sewerage ponds are situated near the Belgirinalla. The over flow of fly ash, hot water and other wastes directly mixes with water of Belgirinalla. It is an important water sources for the village Parasabhatha and Belgiri Basti. Both Parasabhatha and Belgiri Basti is a densely populated labour colony. This water body run east to west and spread over 20-22 km across many villages. This water body is used for irrigating crops of village Belakshar, Dondro, Parasabhatha, Belgiri Basti and Sangam Nagar, washing of cloths and bathing. Fine particles of fly ash released from power generating units, red mud from aluminum smelting unit, fertilizers, pesticides, domestic and other wastes flow with water in dissolved state and heavy particles settles down over the soil surface of above mentioned water body¹. Fly ash and red mud containing alkaline oxides, non-metallic oxides and alarming amount of trace and toxic elements and generate various kinds of skin diseases when it is mixes with water. The present investigation highlights the adverse effect of surface water and sediment of Belgirinalla due to mixing of industrial,

agricultural and domestic wastes. The study was taken from July 2008 to June 2011 by seasonal planning on River Belgiri Nalla in Balco Nagar, Korba near the industrial units.

Material and Methods

The sampling was made from July 2008 to June 2011 by seasonal planning monsoon, winter and summer. The Physicochemical parameters were analyzed in water samples which is given in table 1 and 2 by standard method adopted N.Manivasakam, Pragati Prakashan Meerut INDIA and APHA 21st edition Washington D.C. 2005 and text book of soil chemical analysis Hess P.R.²⁻⁴.

Results and Discussion

The various physico-chemical parameters were estimated from the collected water and sediment samples at sampling sites S1 and S2 are given in table 1 and 2.

The temperature of water has extreme ecological consequences. It was observed that the temperature of this water body has increased due to mixing of hot wastewater coming from industrial units; its value was recorded between the ranges of 19 to 31°C. WHO and IS provided guidelines for pH 6.5 to 8.5 as ideal for aquatic ecosystem, its values was recorded between the ranges of 6.35 to 9.98, water of the study points was found basic in summer season. The conductivity of the sampling points was recorded between the ranges of 999 micro mhos /cm to 1758 micro mhos/cm. The higher values of conductivity of this region may be due to mixing of industrial effluents, dissolution of wastewater from sewage, fertilizers, and soil erosion. The APHA specifies water turbidity should not exceed 0.5 NTU and should ideally be below 1 NTU^{4,5}, it was observed that between the ranges of 5 NTU to 14 NTU.

Table-1
Sampling Point-S1: Near Parasabhatha Shivpara starting of Fly Ash and Sewerage Dam

Parameter	Year 2008-2009			Year 2009-2010			Year 2010-2011			Standards	
	M	W	S	M	W	S	M	W	S	WHO	IS
Temperature	20	19	29.2	21	21	31	22.5	19	30	-	-
pH	7.80	7.40	8.6	7.80	7.40	9.10	6.50	6.35	9.45	6.5-8.5	6.5-8.5
Conductivity in Micro mhos/cm	1054	1312	1738	1001	1487	1722	999	1442	1508	250-500	-
Turbidity in NTU	18	19	28	15	21	24	21	25	29	1-5	5-10
TS	1237	1796	2190	1234	1843	2356	1211	1678	2193	1000-1500	-
TDS	997	1154	1543	978	1156	1654	898	1324	1425	500-1500	500-1500
TSS	240	642	647	256	687	702	336	519	931	-	-
DO	8.2	8.8	6.0	7.8	8.3	6.0	8.0	8.9	6.1	-	-
BOD	2.1	3.6	5.5	2.8	3.9	5.2	3.2	3.9	5.2	-	-
COD	5	8	14	6	9	17	4	11	18	-	-
Hardness	235	268	300	215	285	298	244	230	278	60-180	60-180
Sulphate	48	63	155	52	65	178	58	73	175	200-400	200-400
Fluoride	0.2	0.6	0.8	0.3	0.5	0.9	0.2	0.5	1.4	1.5-2	1.5-2
Chloride	26	39	72	26	46	68	29	30	62	0.2-250	0.2-250
Nitrate	0.5	0.8	1.7	0.8	1.4	1.8	0.6	1.3	1.9	-	-
Nitrite	0.08	0.09	0.16	0.05	0.06	0.17	0.06	0.07	0.17	-	-
Ammonia	0.01	0.02	0.04	0.03	0.04	0.03	0.04	0.02	0.05	0.02	-
Phosphate	0.9	0.9	1.4	0.8	1.2	1.6	0.4	1.1	2.6	0.1	0.1
Acidity	29	49	55	34	53	63	30	48	59	-	-
Alkalinity	81	92	113	78	99	118	72	99	116	-	-
Pb in water	0.002	0.01	0.02	0.002	0.02	0.05	0.003	0.01	0.04	0.01	0.01
Cd in water	0.02	0.02	0.05	0.002	0.02	0.05	0.01	0.02	0.03	0.003	0.003
Pb in sediment	0.06	0.19	0.32	0.07	0.15	0.40	0.09	0.21	0.35	0.003	0.003
Cd in sediment	0.06	0.16	0.29	0.04	0.17	0.28	0.05	0.18	0.29	0.003	0.003

Table No. -2
Sampling Point -S2: Near Parasabhatha across the bridge polytechnic collage road

Parameter	Year 2008-2009			Year 2009-2010			Year 2010-2011			Standards	
	M	W	S	M	W	S	M	W	S	WHO	IS
Temperature	21	19.8	30	20.8	22.4	32.2	20	19.8	31	-	-
pH	7.30	7.50	8.9	7.30	7.50	9.29	7.30	7.98	9.98	6.5-8.5	6.5-8.5
Conductivity in Micro mhos/cm	1096	1313	1678	1082	1502	1758	992	1478	1686	250-500	-
Turbidity in NTU	22	21	30	21	24	31	24	27	30	1-5	5-10
TS	1327	1745	2195	1121	1767	2202	1146	1865	2198	1000-1500	-
TDS	996	1143	1443	989	1209	1658	879	1387	1543	500-1500	500-1500
TSS	331	602	752	332	558	544	267	478	655	-	-
DO	8.0	8.9	6.2	7.4	8.4	6.8	8.9	8.8	6.0	-	-
BOD	2.6	3.5	6	2.5	3.8	5	2.8	3.8	6.1	-	-
COD	7	9	16	4	8	19	5	16	21	-	-
Hardness	242	272	299	270	279	296	236	236	282	60-180	60-180
Sulphate	42	64	168	43	65	165	66	89	189	200-400	200-400
Fluoride	0.1	0.5	0.9	0.2	0.6	0.8	0.3	0.6	1.2	1.5-2	1.5-2
Chloride	28	31	64	29	36	73	31	26	78	0.2-250	0.2-250
Nitrate	0.3	1.2	1.5	0.7	1.1	1.6	0.7	1.2	1.8	-	-
Nitrite	0.07	0.08	0.16	0.06	0.07	0.17	0.05	0.08	0.10	0.2	-
Ammonia	0.02	0.04	0.05	0.04	0.07	0.05	0.05	0.08	0.06	0.02	-
Phosphate	0.6	0.6	1.9	0.8	1.3	1.5	0.6	0.9	2.5	0.1	0.1
Acidity	27	48	58	37	43	69	29	51	67	-	-
Alkalinity	86	95	102	81	102	115	69	89	118	-	-
Pb in water	0.01	0.02	0.03	0.003	0.03	0.04	0.002	0.03	0.05	0.01	0.01
Cd in water	0.01	0.03	0.03	0.002	0.03	0.04	0.02	0.03	0.05	0.003	0.003
Pb in sediment	0.07	0.20	0.24	0.05	0.22	0.30	0.08	0.22	0.34	0.003	0.003
Cd in sediment	0.05	0.10	0.38	0.05	0.12	0.29	0.02	0.21	0.30	0.003	0.003

Note: All results in Mg/L except temperature, pH, conductivity and turbidity. M= Monsoon, W= Winter, S= Summer

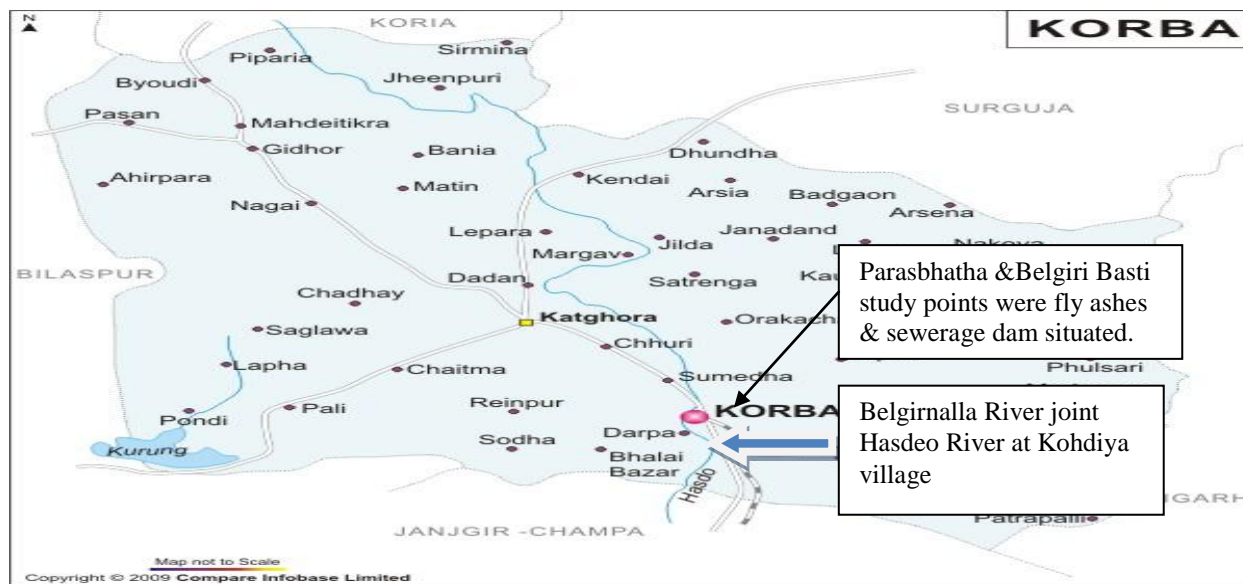


Figure-1
River Hasdeo of Korba District C.G. India, shown in Blue Color

The higher turbidity of this site may be due to mixing of industrial and other water soluble wastes. TS, TDS and TSS of this water body was found higher to the limits, WHO and IS provided guidelines for TDS not to exceed more than 250 mg/L^{6,7}. Dissolved oxygen of the sampling points was found that the lower in summer season while higher in winter, its values was recorded between the ranges of 6 mg/L to 8.9 mg/L. WHO, IS and BIS provided guidelines for the solubility of atmospheric oxygen in fresh water ranges from 14.6 mg/L at 0°C and about 8.6 mg/L at 25°C under 1 atmospheric pressure^{8,9}. Biological Oxygen Demand indicates microbial pollution in water, the results indicate that water of Bellgirnalla was much suffer from microbial pollution in summer, its values was recorded 2.1 mg/L to 6.1 mg/L¹⁰. Chemical Oxygen Demand of the sampling points was recorded 4 mg/L to 21 mg/L. Chemical oxygen demand was recorded higher in summer and indicates chemical pollution load and may be due to continuous mixing of wastes of industries, fertilizers and domestic¹¹. WHO and IS, provide guidelines for hardness not to exceed 180 mg/L⁹. The hardness of the sampling points was recorded between the ranges of 236 mg/L to 300 mg/L. The problems caused by sulphate gives a bitter taste to water if it exceeds a concentration of 250 mg/L¹². Its concentration was recorded between the ranges of 42 mg/L to 189 mg/L. High concentration of fluoride more than 1.5 mg/L causes various type of fluorosis^{13,14}. It was recorded between the ranges of 0.1 mg/L to 1.4 mg/L. Chloride concentration of the sampling points was recorded between the ranges of 26 mg/L to 78 mg/L. The concentration of chloride in water is not exceeding 250 mg/L. However, 1mg/L Chloride content in water it affects fish and aquatic organisms^{11,16}. Nitrate nitrogen of the sampling points was recorded within the limits. However its small quantity reacts with various compounds present in our body and form carcinogenic compounds¹⁷. WHO, IS and OATA provided guidelines for ammonia should not to

exceed 0.02 mg/L in water. In present study, it was found that higher than the limits. It was recorded between the ranges of 0.01 mg/L to 0.08 mg/L. Nitrite nitrogen of the sampling points was found higher than limits, it was recorded between the ranges of 0.05 mg/L to 0.17 mg/L. Phosphate is harmful because they increase the growth rate of blue green algae causing the water unsuitable for bathing¹⁸. Its concentration was recorded between the ranges of 0.4 mg/L to 2.6 mg/L; its concentration should not exceed 0.1mg/L in water. Acidity of the sampling points was recorded under the limits and the alkalinity of the sampling points was recorded minimum 69 mg/L and maximum 118 mg/L. Lead and Cadmium concentration of the sampling points was recorded between the ranges of 0.08 mg/L to 0.35 mg/L and 0.02 mg/L to 0.30 mg/L respectively. WHO provide health based guidelines for Cd is not to exceed 0.003 mg/L and Pb 0.01mg/L^{19,20}. The higher values of lead and cadmium in sediment was due to deposition of industrial and auto-mobile wastes¹⁴.

Conclusion

Human beings are in the top of food chain and they receive the toxic elements and suffer from various diseases. The environmental impact of physico-chemical parameter and heavy metals in aquatic system is immense; hence attempt should be made to assess the load of certain pollutants. Heavy metals are not biodegradable and they tend to accumulate in plants and animals. Hence, it is necessary to determine heavy metals in sediment. On the basis of water and sediment analysis, it was conclude that the water and sediment soil of the study points were affected when the results was compared with IS and WHO. Water and sediment of the study area is not fit for irrigation, bathing and other purpose without proper treatment.

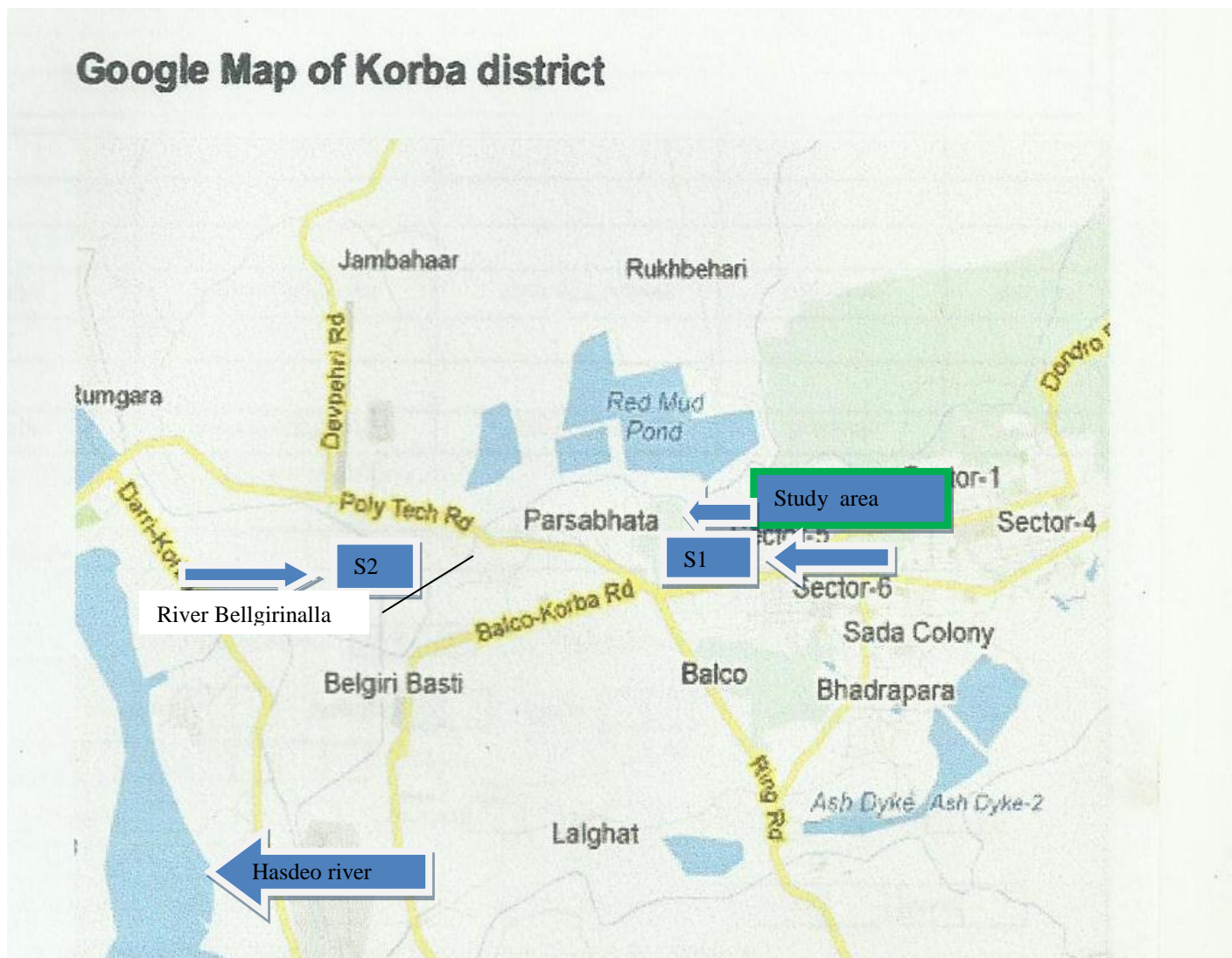


Figure -1
Study area location map²¹, S1 and S2 in the map is sampling sites

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