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Studies of Water Pollution in the Subarnarekha River around the Industrial Area of Jamshedpur

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ABSTRACT:

The Subarnarekha River and the Kharkai River is the lifeline of Jamshedpur. These rivers are social, cultural and religious heritage of the people living nearby. Both these rivers are highly polluted throughout their stretch, especially at Jamshedpur, by Human activities, Municipal and Industrial wastewater discharge. High values were obtained for a number of parameters at site-1. Cyanide and iron content are very high.

Key words: spectrophotometer, cyanide, wastewater, water pollution, iron content.

1. INTRODUCTION:

Jamshedpur is the largest Industrial city of Jharkhand. There are five big industries of iron products besides several small and cottage industries .It is situated in the middle of the Subarnarekha river valley and located in the angle formed by the Kharkai river with the Subarnarekha river.

The Subarnarekha is an interstate river flowing through the states of Jharkhand, West Bengal and Odissa into the Bay of Bengal. Industries located at Jamshedpur take municipal and industrial water from the Subarnarekha river and also discharge their waste water into the river.

The effluents discharged from Coke-ovens and by-product plants, co-batteries, Blast furnace, Sintering plants, Power plants, Steel meltingshops, lime and dolomite plants Foundries, Refractories, Metal refining and electroplating; contain large quantities of Cyanides, thiocyanates, ammonia, phenolic compounds, oil and grease, aromatics organics, TSS, TDS Heavy metals and their ions.

2. EXPERIMENTAL:

Representative samples of River water were collected from the Subarna Rekha River sampling site – 1 (Near Sunsungharia drain), site – 2 (Near Jubilee lake outlet, Mango Bridge) & (Do muhani, Sonari) bimonthly for one year.
Physico-chemical analysis was carried to determine pH value ,electrical conductivity, total hardness, total dissolved solids, total alkalinity, phenolic compounds, cyanide ,sulphate , chloride ,iron , mercury ,hexavalent chromium, coliform bacteria of all samples by using standard method (APHA 1990) .

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3.EXPERIMENTAL DATA TABLE

Table.1:- Water Quality Of Suberna Rekha River At Site -1

PARAMETERS	JAN-11	MAR-11	MAY-11	JULY-11	SEPT-11	NOV-11	JAN-12
TEMP-A/W ^{0} C	26/20	37/34	36/34	30/28	34/32	34/28	24/19
pH	5.90	5.60	5.88	6.72	7.00	6.80	5.80
ALKALINITY mg/l as $CaCO_3$	60.0	70.0	140.0	40.0	70.0	100.0	110.0
Ca-hardness mg/l asCaCO3	66.0	91.2	58.0	30.5	70.0	74.0	68.0
Mg-hardness mg/l as CaCO3	44.2	40.2	48.2	19.0	24.3	42.0	40.2
TOTAL HARDNESS	110.2	131.4	106.2	49.5	94.3	116.0	108.2
SULFATES mg/l	30.0	12.6	13.5	30.0	18.0	17.3	14.0
CHLORIDES mg/l	35.0	24.0	35.0	09.0	09.0	36.0	18.0
CYANIDES mg/l	01.50	01.4.	01.50	00.67	01.8	01.50	01.40
PHENOLS mg/l	08.0	07.0	04.0	05.0	08.1	08.2	07.8
IRON CONTENT mg/l	03.22	03.41	03.42	03.21	03.34	03.34	03.32
MERCURY CONTENT mg/l	NT	0.00	NT	NT	0.01	0.02	0.001
Cr(vi) mg/l	0.78	1.03	0.89	0.44	0.81	0.91	1.01
DO mg/l as O_2	4.6	5.6	6.9	6.2	5.4	6.3	8.0
BOD mg/l as O_2	6.2	8.4	4.2	8.6	5.0	4.0	5.0
COD mg/l as O_2	20.0	20.7	32.0	36.2	20.0	18.0	38.0
TSS mg/l	571.0	135.0	246.0	224.0	800.0	200.0	125.0
TDS mg/l	200.0	115.0	303.0	443.0	120.0	386.0	386.0
SP.COND u-mho/cm	500.0	828.0	700.0	502.0	707.0	677.0	662.0
E.COLI mpn/100ml	3300.0	4600.0	16000.0	54000.0	11000.0	54000.0	3300.0
TOTAL BACTERIA mpn/100 ml	14000.0	96000.0	86000.0	94000.0	54000.0	96000.0	15000.0

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Table.2 : Water Quality Of Suberna Rekha River At Site -2

PARAMETERS	JAN-11	MAR-11	MAY-11	JULY-11	SEPT-11	NOV-11	JAN-12
TEMP-A/W ^{0} C	24/22	37/32	37/33	30/28	34/32	34/28	23/20
PH	8.00	8.06	8.06	8.40	8.20	8.06	8.50
ALKALINITY mg/l as $CaCO_3$	70.0	82.0	102.0	70.0	65.0	82.0	68.0
Ca-hardness mg/l asCaCO3	52.0	54.0	60.0	34.0	46.0	62.0	65.4
Mg-hardness mg/l as CaCO3	34.0	32.1	18.0	13.0	26.0	26.1	78.3
TOTAL HARDNESS	86.0	86.1	78.0	47.6	72.0	88.1	144.7
SULFATES mg/l	14.0	6.6	46.0	12.0	14.5	12.0	13.0
CHLORIDES mg/l	18.0	16.0	18.0	9.0	8.0	16.0	66.0
CYANIDES mg/l	NT	NT	NT	NT	NT	NT	NT
PHENOLS mg/l	NT	NT	NT	NT	NT	NT	NT
IRON CONTENT mg/l	1.63	1.72	1.72	1.67	1.72	1.74	1.74
MERCURY CONTENT mg/l	NT	NT	NT	NT	NT	NT	NT
Cr(vi) mg/l	0.40	0.43	0.41	0.21	0.42	0.40	0.42
DO mg/l as O_2	6.5	7.6	6.5	7.9	6.0	6.4	8.1
BOD mg/l as O_2	8.2	6.2	3.1	6.5	6.6	7.2	7.1
COD mg/l as O_2	86.0	91.0	80.0	76.0	72.0	78.0	91.0
TSS mg/l	30.0	59.0	36.0	60.0	45.0	51.0	65.0
TDS mg/l	400.0	459.0	632.0	332.0	418.0	502.0	417.0
SP.COND u-mho/cm	380.0	354.1	372.0	432.0	337.0	380.0	343.0
E.COLI mpn/100ml	3200	7000	7900	4900	7000	11000	860
TOTAL BACTERIA mpn/100 ml	9400	54000	54000	54000	28000	54000	3300

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Table : 3 : Water Quality Of Suberna Rekha River At Site -3

PARAMETERS	JAN-11	MAR-11	MAY-11	JULY-11	SEPT-11	NOV-11	JAN-12
TEMP-A/W ^{0} C	25/20	38/32	37/33	30/27	34/31	34/28	23/20
PH	7.50	7.40.	7.50	7.50	7.50	7.50	7.50
ALKALINITY mg/l as $CaCO_3$	72.0	66.0	74.0	70.0	45.0	66.0	82.0
Ca-hardness mg/l asCaCO3	44.0	42.0	44.0	26.2	18.0	36.0	50.0
Mg-hardness mg/l as CaCO3	18.8	28.0	18.1	6.0	16.0	18.0	14.0
TOTAL HARDNESS	62.8	70.0	62.1	32.2	34.0	54.0	64.0
SULFATES mg/l	8.0	6.6	8.0	16.0	10.5	10.5	8.0
CHLORIDES mg/l	11.0	8.0	10.5	13.0	9.0	9.0	10.0
CYANIDES mg/l	NT	NT	NT	NT	NT	NT	NT
PHENOLS mg/l	NT	NT	NT	NT	NT	NT	NT
IRON CONTENT mg/l	0.20	0.22	0.19	0.15	0.21	0.22	0.19
MERCURY CONTENT mg/l	NT	NT	NT	NT	NT	NT	NT
Cr(vi) mg/l	0.02	0.02	0.03	NT	0.04	0.04	0.05
DO mg/l as O_2	8.6	8.0	7.3	7.8	7.0	7.0	7.9
BOD mg/l as O_2	5.3	5.9	6.3	6.7	6.1	6.1	5.3
COD mg/l as O_2	27.0	24.0	44.0	43.0	34.0	34.0	24.0
TSS mg/l	45.0	50.0	49.0	48.0	49.0	51.6	52.0
TDS mg/l	301.0	287.0	271.0	272.0	287.0	265.0	201.0
SP.COND u-mho/cm	170.0	187.2	208.0	201.0	150.4	150.8	156.0
E.COLI mpn/100ml	1100	1100	400	1100	2200	200	400
TOTAL BACTERIA mpn/100 ml	4600	2300	2300	2300	9200	1700	800

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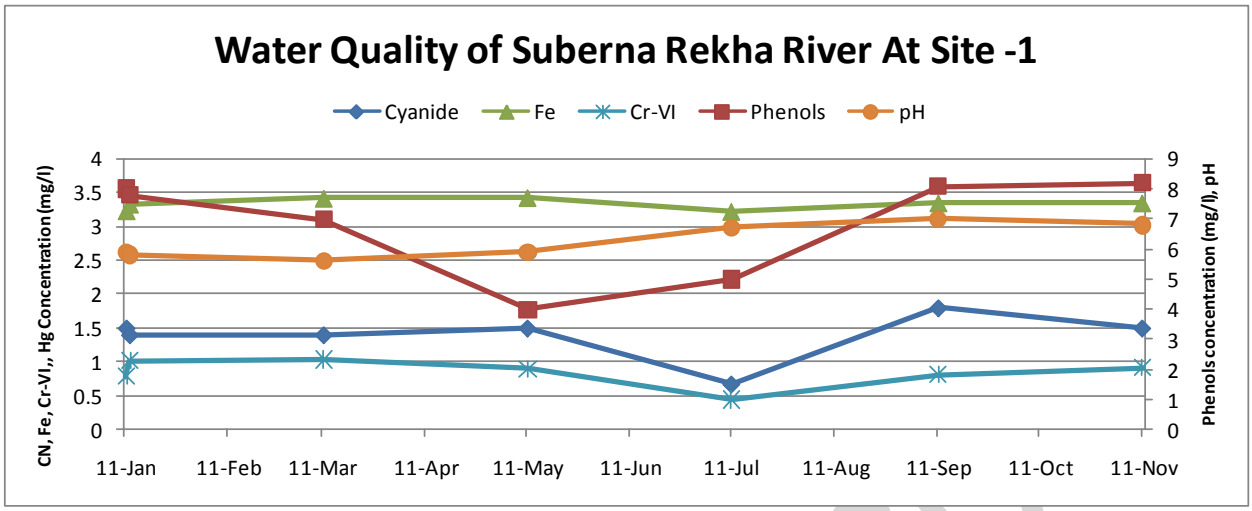

4. RESULTS AND DISCUSSION:

The quality of water is a vital concern for mankind since it is directly linked with human existence. It is a matter of history that faecal pollution of drinking water caused water borne diseases which wiped out entire population of cities. At present, the menace of water-borne diseases and epidemics still looms large on the horizons of developing countries. Polluted water is the culprit in all such cases.

The physical verification and experimental results of water samples from January 2011 to January 2012 indicate that the Subarnarekha River is highly polluted in Jamshedpur. The quality of water is not suitable for domestic, industrial and agricultural uses. The polluted water is the source of water borne diseases in the locality of Jamshedpur. People are suffering from dysentery, diarrhoea, typhoid and paratyphoid fever, cholera, jaundice, polio, ulcer, skin diseases etc. the polluted water is also harming agricultural crops, aquatic life, animal life and industrial units.

The water pollution in Subarnarekha River is due to:

1. Industrial waste water
2. Municipal sewage
3. Domestic sewage and waste water
4. Agricultural waste and waste water
5. Some other occasional and seasonal factors like Cremation, statues immersion, human excreta and urine, animal excreta etc.

The examination of quality of water at different sites of the river, indicate that the industrial waste and waste waters containing hazardous chemicals are causing major pollution. Industries located in and around Jamshedpur are discharging their untreated waste water directly into these rivers, destroying the quality of water, M/s. Tata Steel and Associated Companies are at the top of the list of water and air polluters.

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An overall survey of the results of parameters studied and possible measures for controlling water pollution are discussed below:

Subarnarekha River receives the waste water from Tata Steel through Sunsungharia drain (Site – 1) and Garam nala (Site – 2).

High values were obtained for a number of parameters at Site – 1

PH	- 5.60 to 7.0
Alkalinity	- 60.0 to 140.0 mg/l
Total hardness	- 49.5 t0 131.4 mg/l
Cyanides	- 0.67 to 1.80 mg/l
Phenols	- 4.0 to 8.2 mg/l
Iron content	- 3.22 to 3.42 mg/l
Mercury content	- Up to 0.02 mg/l
Chromium (VI)	- Up to 1.03 mg/l

Specific conductance = Up to 828.0 μ – mhos/cm, Low DO. High BOD, COD, TSS, TDS and faecal coli forms were obtained.

The river water at this site is highly acidic. Hence, the economic value of the water for drinking and washing purposes is lost. Also, aquatic life would not survive in this highly acidic water.

The cyanide content is very high. Free cyanide (as CN or HCN) is toxic. It interacts with ferric haem moiety of cytochrome oxidase and blocks respiration. Phenolic compounds are also very high. Simple phenolic compounds often are biocidal. Lower forms of life, generally, are more severely affected than higher forms and aquatic forms more so than terrestrial or avian. Degree of toxicity varies greatly with the particular compound. Phenols impart such an objectionable taste and odour to water and food that toxic exposure seldom occurs. Although this is fortunate, it creates the economic problem of removal of the characteristic medicinal taste of phenols in water or the disposal of phenol tainted fish.

Iron content is also very high. As far as it is known, human beings suffer no harmful effect from drinking water rich in iron content but it is unsuitable for processing food, beverages, laundry operations etc. If this water will be used for boiler, then it will lead to a pronounced blocking of the pipes together with rusting of the iron pipes. The boiler may get chocked due to the presence of iron as red mud.

The high concentration of Cr (VI) has following hazardous effects.

1. It affects the biochemical reactions of lower as well as higher plants.
2. It causes skin disorder and liver damage.
3. It is oncogenic (carcinogenic).

The chromium concentration in urine provides information about the current exposure to water soluble chromium (VI) and about the body burden of chromium.

Mercury content is also high. Methyl mercury is highly toxic. It causes irreversible nerve and brain damage. Methyl mercury poisoning also leads to segregation of chromosomes, chromosome breakage in cells and inhibited cell division.

The BOD and DO factors indicate a self-purification ratio of 2 . 44 and the required degree of treatment is 73.6%. This is a very high value which indicates that total processes of treatments are required. The self-purification ratio of such rivers is 3.

Site – 1 receives effluents from power house No.4 in the form of fly ash slurry and from coke-ovens and coke-oven by-product plants. The effluents from power House No. 4 are presently taken into Ash pits for removal of fly ash, before discharging the water into

Sunsungharia drain. This is not adequate measure. A pond should be created after constructing suitable bunds for ponding of fly ash. Clear water from the pond may then be allowed to flow into Subarnarekha River.

Coke oven and Byproduct plants effluent which carries harmful phenols, thiocyanates, cyanides etc. should be treated in a biological oxidation plant (pond) before discharging the effluent into the Sunsungharia drain and then into the river. The coke oven batteries may be charged by a new method.

Suitable measures should be taken to treat effluent water reporting to Garam Nala (Site – 2) from power House No.2 and Blast Furnace.

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REFERENCES:

i. Dr. Sanjay Mishra and Dr. Gangadhar Mishra, Ph. D. Thesis, some studies on water pollution in the Industrial zone of Ranchi, Ranchi University (1985).

ii. Seminar on Environmental Awareness. Organized by The Institution of Engineers and Environmental Management Division, Tata Steel (1988).

iii. Standard methods for the examination of water and waste water, 15th Ed. APHA. AWWA. WPCF, 1990.

iv. Desh Bandhu, Berberet, G., Environmental Education for Conservation and Development, 1st Ed., Indian environmental Society, New Delhi (1987).

v. Sapru, R. K., Environmental Management in India, Volume (I) and Volume (II) Ashish Prb. House, New Delhi (1987).

vi. Agarwal, V. P., and Rana, S. V. S., Environment and Natural resources, Society of Biosciences, 1st Ed., Jagmandir Book Agency, New Delhi (1986).

vii. Fred Gurnham, C., Industrial Waste Water Control, Academic press, New York (1965).

viii. Kurt. J. Irgolic and Arthur E. Martell, Environmental Inorganic Chemistry, V. C. H. Publishers, U. S. A. (1985).

ix. Qinby Hunt, M. S. Mclaghlin, R. D., Quinta nilha, A. T. Instrumentation for Environmental Monitoring. 2nd Ed., Volume – 2, Water, John Wiley and Sons, California (1986).

x. Krenkel, P. A., Heavy metals in the Aquatic Environment, an International Conference, 1st Ed., Pergamon Press Ltd. Oxford (1975).

xi. Suess, M. J., Examination of water for pollution control, W. H. O., Vol. 3., 1st Ed., Pergamon Press, Oxford (1982).

xii. World Health Oraganisation Technical Report No. 517 (1973).

xiii. Department of Environment, Govt. of India, An Acton plan for Prevention of pollution of the Ganga (1985).

xiv. Bridgewater, A. V. and Mumfored, C. J., Waste Recycling and pollution Control Hand Book, Van Nostrand Reinhold Company (1979)

xv. USEPA, Land Treatment of Municipal Waste Water: Process design manual (1981).

xvi. Mohanrao, G. J., Indian Journal of Environmental Health. 15 (3), pp. 223 – 225 (1973).

xvii. De Bruin A., Biochemical toxicology of environmental agents, Elsevier, North Holland (1976).

xviii. Brown, S. S. and Savory, J., Chemical toxicology and clinical chemistry of metals, Academic Press, Inc. New York (1983).

xix. URONE, P.F. Stability of Colorimetric Reagent for Chromium. s – Diphenylcarbazide, in Various Solvents. Anal. Chem. 27 : 1354, 1955.

xx. A.K.De, Environmental Chemistry, 2nd Ed. Wiley Eastern Ltd. New Delhi, 1989.

xxi. Vogel; Text book of Quantitative Inorganic analysis, 4th Ed. ELBS, London 1985.