Middle-East Journal of Scientific Research 22 (12): 1760-1770, 2014
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2014.22.12.21634

A Study of Water Pollution in Two Major Rivers in Odisha-Mahanadi and Brahmani

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Abstract: Water is said to be our life because we need it fordrinking, bathing, relaxing, fishing and irrigatingour crops. Besides, we produce energy fromwater and navigate in it. Water is so an essentialresource for our life that ancient civilizations have been developed in almost all river valleys of ourcountry. With the growth of the modern civilization, our life is threatened due to pollution of waterboth from surface and underground. The doctorsforecast that several stomach, lever and skin diseases spread due to polluted water. In ourcountry, especially in the state of Orissa, thescarcity of pure drinking water is so much feltthat 50% of urban people and 80% of rural peopleare affected by water pollution.In the present research program the status of pollution of water in two major rivers namely Mahanadi and Brahmani of Odisha has been analysed. The main pollutant of water in Mahanadi is the sewerage systems in sambalpur and Cuttack town whereas the main pollutant of Brahmani is the effluents of Rourkela steel plant and many other chemical factories.

Key words: Waterb Pollution · Odisha · Mahanadi · Brahmani · Sambalpur · Cuttack · Rourkela

INTRODUCTION

Water is said to be our life because we need it for drinking, bathing, relaxing, fishing and irrigating our crops. Besides, we produce energy from water and navigate in it. Water is so an essential resource for our life that ancient civilizations have been developed in almost all river valleys of our country. With the growth of the modern civilization, our life is threatened due to pollution of water\ both from surface and underground. The doctors forecast that several stomach, lever and skin diseases spread due to polluted water. In our country, especially in the state of Orissa, the scarcity of pure drinking water is so much felt that 50% of urban people and 80% of rural people are affected by water pollution [1-10].

Sources of Water in Orissa: The main sources of water in the state are from the Bay of Bengal, from lakes like Chilikaand Ansupa, from 11 rivers such as : Mahanadi, Bramhani, Baitarani, Rushikulya, Budhabalanga, Subarnarekha, Salandi, Kathajodi, Birupa, Kusabhadra, Daya and many rivulets. The water sources include ground water, tanks, ponds, open wells and tubewells.

Quality of Water: The pure water that is H2O in which two parts of hydrogen and one part of oxygen are present. Obviously, this form of pure water is not available in all the above mentioned sources. The quality of water depends on the quantity of harmful elements present in it. The water from sea and Chilika lake is salty and the water from rivers, tanks and ponds is very often muddy and contain impurities of suspension, colloids and dissolved particles. The quality of drinking water depends on the quantity of harmful elements present in it. The drinking water should be clear, odourless and tasteless and its pH value should be between 7 & 8.5. According to the World Health Organization (WHO), the permissible limits of impurities in drinking water are as follows [11-16].

The permissible organic impurities include Bacillus coli less than 100ml/lit and other coli acteria not more than 10 numbers.

How Water Is Polluted: Water pollution means contamination of water due to introduction of some external materials. Water may be polluted either from natural sources or human sources.

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Impurities Maximum permissible	limits (mg/Lit.)
Total Solids	500
Hardness	2meq/lit
Calcium	75.0
Magnesium	30.0
Sulphates	200.0
Chlorides	200.0
Iron	0.10
Manganese	0.05
Copper	0.05
Zinc	0.05
Arsenic	0.05
Cadmium	0.005
Cyanide	0.05
Lead	0.05
Mercury	0.001
Phenolic Elements	0.001

How Water Is Polluted: Water pollution means contamination of water due to introduction of some external materials. Water may be polluted either from natural sources or human sources.

Pollution Through Natural Sources: The natural elements which cause water pollution are gases, soil, minerals, humus materials, waste created by animals and other living organisms present in water. During rain, surface\ water with soil, mud and humus enter into the river,\ tanks and other water bodies. The inorganic\ minerals like sodium, potassium, calcium, magnesium and heavy metals like iron, manganese, lead, mercury, chromium, cadmium, nickel, cobalt, beryllium when present above the permissible limit are harmful for drinking. Ground water containing Floride above 0.15 mg/lit. At Begunia in Khurda district, in six villages (Dergaon, Jutiki, Behal, Sargiguda, Kirojhote and Kandhamal) of G.P. Korlakata of block Boden Nuapada district causes diseases like Florosis, bone and teethdeformation, in both human beings and animals [17-25].

Pollution of Water Through Human Sources: The human sources of water pollution are due to one of the followings:

Discharge of Domestic Effluents: In urban areas people use about 335 litters of water daily for different domestic purposes. About 70-80 percent of this water drains out to the nearby ponds, tanks or rivers through the drains or nasal of the municipality, thereby polluting the water.

Discharge of Sewage: Municipal sewage is considered to be the main pollutant of water. Most of the sewage receives no treatment before discharge in all the cities of Orissa. The cities like Bhubaneswar, Cuttack, Rourkela, Jabalpur and Berhampur generate approximately 10, 7.5, 6.0, 3.075 and 5.0 lakh litres of sewage effluents respectively every day. These effluents are discharged into the river Mahanadi and Kathajodi in Cuttack, Kuakhai and Daya in Bhubaneswar, Brahmani in Rourkela, Mahanadi at Sambalpur and Rushikulya at Berhampur. The effluents contain heavy metals like lead, chromium, cadmium, zinc and mercury. Besides, the sewage\ effluents are rich with harmful bacteria and viruses which contaminate the river water. While drinking this contaminated water, people suffer from serious diseases [26-30].

Discharge of effluents from smelter plants of NALCO to the water bodies at Angul cause fluoride pollution in drinking water of wells and tanks through lateral and vertical movement in ground. The water of these sources contains fluoride more than 1.5 mg/lit. which is toxic to animals. Fly ash effluents from captive power plants of Angul, Talcher and Damanjodi contain heavy metals like chromium, lead, cadmium and iron. These effluents discharged to the nearby rivers and ponds pollute the water. The river, Nandira, at Talcher is said to be dead due to discharge of fly ash effluents into the river. The river Nandira and the creeks receiving fly ash effluents join to the river Brahmani in which the water is polluted with the heavy metals as mentioned above. Press-mud effluents from sugar mills of Aska, Rayagada, Nayagarh, Dhenkanal,Badamba and Deogaon (Bolangir) contain heavy metals like Iron (2500-8000 ppm), Manganese (280-1500 ppm), Copper (90-126 ppm) and Zinc (155-272 ppm). These effluents discharged to the nearby water bodies pollute the water. The effluents from Chlorine Plant at\ Chhatrapur containing high Chloride of more than 250 ppm and SAR value of more than 10 meq/ lit. cause chloride and sodium toxicity to the river Rushikulya. The ground water of open wells near the plants was detected containing high amounts of Chloride. The Phosphatic Fertilizer Industry at Paradeep discharges effluents containing Nitric, Sulphuric and Phosphatic acids to the joining mouth of the river Mahanadi into the Bay ofBengal. Liquid Ammonia released from the plantcause pollution to the water in wells and tanks innearby villages [31-40].

Mining Operations: Discharge of Hexavalent Chromium from Chromite mines at Sukinda of Jajpur district pollutes the water of rivulet Dharmasala as well as the water in ponds and wells in around 2-5 km. radius of the mining operation. Leachates of soluble iron from mines of iron ore pollute the water of river Mahanadi into the Bay of Bengal. Liquid Ammonia released from the plant cause pollution to the water in wells and tanks in nearby villages.

Agricultural Effluents: Agricultural water pollution is caused by fertilizers, insecticides,pesticides, farm animal wastes and sediments.Research findings indicate that application and heavy doses of fertilizers pollute ground water through leaching of nitrate from nitrogenous fertilizers and of cadmium from single Superphosphate and of flouride from rock Phosphates. However, such hazardous effects in ground water of Orissa have not been detected so far. The use of various types of pesticides and insecticides in agriculture cause water pollution. Death of aquatic animals have been reported in intensive rice growing areas of Orissa due to application of granular pesticides like Furatox and Furadon. Careless deposit of animal waste close to the wells and ponds situated in the backyards cause pollution of water through leaching. The pathogenic organisms of these wastes transmit to the water and pose serious problems[41-50]

Man-Made Water Pollutions: It is reported that during the last Dashara festival about 5000 idols of Goddess Durga were immersed in different rivers of Orissa which caused lead pollution in river water. It is estimated that one Durga idol weighing 200 kgs. contains 1.5 kg. lead. Thus 5000 Durga idols when immersed will add 7500 kgs. lead to the water. In similar case, 1 lakh idols of Ganesh immersed in water bodies add 1500 kgs. lead each idol containing 15gm lead.

Effect of Water Pollution: Pollution of water probably cause more illness of human being than any other environmental influences. The sewage and polluted water are responsible for several water borne diseases such as : cholera, typhoid, infantile diarrhoea, dysentry, infectious hepatitis, polio, ziardiasis, jundice etc. Presence of Cadmium in water, due to\ various industrial discharges and mining wastes, cause high blood pressure, kidney damage, destruction of testicular tissue and red blood cells.Occurrence of hexavalent chromium due to mining of chromite ores cause nausea, skin ulceration, lung cancer and liver damage. Fluorine in drinking water from various sources cause Florosis characterised by mottle of teeth and bone damage. Lead in drinking water added through sewage, industrial effluents and paints cause anaemia, kidney diseases and nervous disorders. Addition of mercury from industrial wastes, mining of coal and application of pesticide cause paralysis of nerve and brain. Water pollution changes the physical and physiological nature of water. Presence of organic dyes changes the colour of the water. Release of sewage and industrial effluents to water bodies cause turbidity in water. Decomposition of organic matter, algae, fungi and filamentous bacteria impart add odors and taste to water. The industrial effluents containing several types of chemicals cause loss of soil fertility. In general, water pollution has now become a threat to the eco-system and an\important cause of environmental pollution.

Pollution in Mahanadi: The discharge of municipal\ sewage, industrial effluents and biomedical waste into the Mahanadi has raised concerns about environmental sustainability and also posed a serious threat to the health of people living on the banks. This article critically examines\ the river pollution caused by the spiralling urbanisation and industrialisation along with\ dumping of waste by many medical facilities. There is an urgent need to address this enormous challenge which is a direct outcome of inefficient planning and management. In Orissa, as a result of the population influx into urban areas and industrialisation, the water withdrawals fromrivers, lakes and reservoirs have increased four fold in the last two decades; the discharge of wastewater into water-bodiesfar exceeds the self purification capacity.Industrial chemicals and hazardous effluentsand raw domestic sewage are the twomain pollutants of rivers. In addition to\this is the threat from the biomedicalwaste of the growing healthcare facilities. Microbial pollution or contaminated\water is believed to be the largest singlecause of infant mortality and diarrhoeathe single highest cause of work days lost. The other diseases resulting from stagnantwater and polluted environments aregastro-enteritis and cholera, typhoid, viralhepatitis and malaria including increasingincidences of brain malaria. not so serious-wanting to ensure a pieceof the state's multi-mineral riches has raisedserious concern sover environmental sustainability, [51-55] specifically pertaining to pollution management and water resources.

Domestic Waste Discharge: The Mahanadi running through 494 km\within Orissa with five main tributaries and four major distributaries is the largestriver system among the 11 rivers in thestate. It has a basin area of 65,628 sq kmwith a population of 1.62 crore projectedto rise to 2.9 crore in 2051 when thepopulation is expected to stabilise. There\are about 34 cities, towns and urban conglomerates in the Mahanadi river basinarea inside Orissa. Among others, thoseheavily populated and directly polluting\habitations are Sambalpur, Choudwar, Cuttack and Paradeep. The Orissa Pollution Control Board (OSPCB) estimates untreateddomestic wastewater discharge from urban\settlements in the Mahanadi basin at3,45,000 m3 (m3 = 1,000 litres) per day,contributing a

biochemical oxygen demand\(BOD) load of about 68.8 tonnes every day [56-60]. Under the Water (Prevention and Controlof Pollution) Act 1974, which governswater quality management in the country, monitoring stations on all major rivers testpollution levels on various parameters\monthly, quarterly or annually. From the 18 monitoring stations for Mahanadi andits major distributaries that OSPCB operates,averaging readings over four years from\2002 to 2006 found that in most stretchesof the river the critical parameters which determined water quality, were of organicorigin, reinforcing the findings of thisstudy that urban domestic waste dischargeis emerging as a more urgent concern than industrial effluent disposal into Mahanadi.Due to the high organic and bacterial\pollution indicators (the total and fecal coliform (TC and FC) and (BOD), the downstream/stretches, which are also water\intake stretches of major towns and cities, Cuttack have been downgraded to grade D/E and that of Paradeep to below grade E because of additional pollution indicators-EC, SAR and chloride coming fromindustrial effluents.have been downgraded severely. The waterintake stretches for Sambalpur and 2 O pen Sewage\A population currently at 1.62lakh (1.54lakh in 2001 Census) and prospectively at4.35 lakh in 2011 [Orissa Water Supply andSewerage Board 2007] Sambalpur townsaw a decadal growth of 66 per cent in1971, 70.5 per cent in 1981, slowing downto around 19 per cent in 1991 and 35 percent in 2001. Inward migration for employmentin industries and ancillary establishments\has resulted in growing slums.\Around 60 per cent of the present populationlives in 101 slums within the 33.6 sq km municipality area.The water\ intake stretches for Sambalpur and\ Cuttack have been downgraded to grade D/E and that of Paradeep to below gradeE because of additional pollution indicators\-EC, SAR and chloride coming fromindustrial effluents.[61-69]

Open Sewage at Sambalpur: A population currently at 1.62 lakh (1.54 lakh in 2001 Census) and prospectively at 4.35 lakh in 2011 [Orissa Water Supply and\Sewerage Board 2007] Sambalpur town saw a decadal growth of 66 per cent in1971, 70.5 per cent in 1981, slowing down to around 19 per cent in 1991 and 35 per\cent in 2001. Inward migration for employment in industries and ancillary establishmentshas resulted in growing slums. Around 60 per cent of the present populationlives in 101 slums within the 33.6 sq kmmunicipality area. Sambalpur town's western flank dischargesthe entire town's untreated sewage from 12 outfalls within a 5 km stretchdirectly into the Mahanadi. In summerwhen the Hirakud dam discharges next tonothing, the river water with the sewagestagnates in patches between overgrown\weeds and riverbed rocks. This is the onlybathing and clothes washing option available\to thousands of people living by the\river including pilgrims to the riverside\shrine of Samalai. The open sewage system of Sambalpur\ Municipal Corporation (SMC) consists of seven minor drains and three major nullah\or natural watercourses which meander 10 to 22 kms each, inside the town, collecting\sewage. The major sewage outfallis through one of these-the Dhobijore. In\1999 it dumped 129.6 kilolitres per day\(KLD) of sewage into the river [70-75]. Water Quality at Sambalpur Division A remarkable and sudden deterioration inwater quality just after the sewage outfall is telling. While Sambalpur upstream shows\low BOD of 1.1 mg/l; just 5 km downstream at Dhobijore, it deteriorates to 3.1 mg/l.\Similarly TC is 2,650 MPN/100ml upstream but deteriorates nearly 14 times to 36,742\MPN/ 100ml downstream. The pressure of rising population density on water pollution\levels too is growing. In 2000, annual\average TC downstream was 15,478\MPN/100ml; six years later, in 2006 it hadmore than doubled to 36,742 MPN/100ml .The OSPCB classifies the water quality ofSambalpur downstream (also public watersupply intake point) as class D and E.Dhobijore being the lowest point in thetopography hereabouts, river water is\deepest here. Barely 15 ft from the sewageoutfall is the public water supply intake\point. The inadequate piped water suppliedto the municipal area is supplemented\by 674 stand posts and 446 handpumps. Sambalpur area has a granitebasement; at some points the water tableremains high unable to percolate becauseof the rock base. These points are penetratedfor tube and dug-wells and also becomethe pathways for sewage contamination of groundwater since water remainsbarely 10 feet below the surface.

Cuttack: A City of Drains: More than a 1,000 years old, the erstwhile\capital of Orissa, Cuttack, is virtually tottering over its drains, particularly duringhe three months of monsoon whenmany areas remain knee deep in waterand the drains invade kitchens and\bedrooms. Until recently, Cuttack's faecal disposal was through manual scavenging. Hence its 20-year-old sewage networkingof just 19 kms covers only 10 per cent of\the city. Urban growth in Cuttack expandedrapidly in the 1960s after developmentof the Paradeep port and construction\of connecting flyover bridges. Two\planned housing settlements with populations\of 10,000 and 1.5 lakh came upon the banks of Mahanadi and on thewestern tip of the Mahanadi-Kathajodirivers bifurcation. While the latter hasa 4.5 million litres per day

(MLD) STP\the former drains its sewage directly into Mahanadi.[76-80] In most areas, household sewage isflushed or washed into the open roadsidedrains. The 192.5 sq km CuttackMunicipality Corporation (CMC) area hasa total of 1,678 kms of drains, which leadto the two main open storm waterdrains, together 22 kms long. An additional29 kms of branch storm waterchannels complete the currently availabledrainage (and sewage) infrastructurein the city. Broadly speaking, domesticwaste water, solid waste and sewage have a single disposal channel. Cloggeddrains, year round overflow into alleys and critical water logging in monsoons\are the result.

The present daily sewage flow is120 litre per capita day (lpcd-calculatedat 80 per cent of water supply) from a citypopulation of 5.35 lakh (Census 2001);sewage generation is projected at88.54 mld in 2011 with the population\increasing to 6.51 lakh, 105.59 mld in2021 with population at 7.93 lakh and160 mld in 2041 with population at12.46 lakh. Ponds and low areas whichcould moderate storm water flow are nowall built up. In 2001 the Pollution Abatement Scheme (PAS) for Mahanadi under theNational River Conservation Programme (NRCP) was implemented in Cuttack.Besides the Mahanadi and Brahmani, 27 other polluted rivers running through 149\towns in 16 states also came under thisscheme. The total approved cost of theprogramme was Rs 3,080 crore and slated to be completed by December 2005

Delays and the Choking: In Cuttack the PAS sought to reduce\pollution from city domestic wastes and effluents from the Jagatpur industrialarea that drains into Mahanadi, its distributor Kathajodi and the Taladanda canal,which is the main irrigation source and bathing ghat for villages along its length. After furores in the state legislative assemblyover the delay, in December 2006, the implementing agency, Orissa Water Supply and Sewerage Board of the departmentof urban development, the governmentof Orissa completed and handedover to the CMC, five sewage interceptionand diversion points. These are sewagecollection points from which the wasteis pumped out into the two main stormwater drains which then carry it to the 33mld sewage treatment plant (STP) at Matagajpur,\located on the Kathajodi riverbank. The STP was handed over in January2007; CMC floated bids to operate andmaintain the STP in September 2007, but\till date a technically suitable agent hasnot been decided upon. The STP idles while the rivers choke with the city'ssewage characterised by BOD 160 mg/l; COD 250 mg/l; suspended solids 158 mg/land coliform count of 1,00,00,000MPN/100ml, (discharges are assumed to\be diluted 10 times in water bodies). With30 low cost public toilets OWSSB's total bill\was Rs 6.84 crore.After two years time over-run, workunder the NRCP is not yet complete. Accordingto member secretary, OWSSB, DilipKumar Padhi:The lack of gradient in Cuttack is our majorobstacle to delivering on time. In someplaces we had to dig to a depth of 23 feet toget the required gravity flow. The high watertable throws up water even at 8 ft depth atplaces which has to be pumped out simultaneouslyfor work to continue; all this rendersprogress slow [81-85].

Industrial Pollution: One of the biggest producers of primaryaluminium in Asia, Hindustan Aluminium Company (HINDALCO) Industries'integratedaluminium plant (smelter plant and captive power plant) is located at theMahanadihead in Hirakud, 5 kms from the dam and 12 kms from Sambalpurtown. HINDALCO's smelter plant in Hirakud is certified ISO 14001 (for exemplary workin practising environmental management). It has installed most required pollutioncontrol systems.

Fertiliser Plants: The only two large fertiliser plants in thestate are in Paradeep the port town, asmost of their raw material is imported.Paradeep Phosphates (PPL) and Indian Farmer's Fertilisers Cooperative (IFFCO) produce 3.0 mt of di-ammonia phosphate (DAP) fertilisers. Their effluent load on Mahanadi is 5,280 KLD released into the Atharbanki creek of Mahanadi. Their totalindustrial pollution load on Mahanadi is BOD at 15 kg/d, COD at 35kg/d and oil andgrease (O&G) at 7.5 kg/d. The town's untreateddomestic sewage too drains into the creek

The water quality at Paradeep, accordingto OSPCB does not qualify even for class E due to several parameters like TC\(annual average in 2006 was 17,386 MPN/100ml); EC (2,412 microsiemen/cmin winter 2006; tolerance limit for class E water is 2,250); SAR (31.06 in April 2006; sodium absorption ratio-indicates the concentration of sodium; tolerance limi for class E water is 26); Chloride (3,497 mg/l in April 2006; industrial effluents may carry chloride; at 250 mg/l gives salty taste, 600 mg/l is the tolerance limits for class E water; at very high concentration can be toxic to crops), TKN (39.8 mg/l in\ April 2006; indicates higher level of ammonia, 0.2 to 2.0 mg/l can be lethal to some variety of fish). The pollution scenario in the industrial\ port town of Paradeep is significantly improved after one of the two fertiliser plants Oswal Chemicals and Fertilisers (OCFL) was acquired by IFFCO in October 2005. Both PPL and IFFCO have installedimproved technologies and have better technical manpower now; not only hasdangerous air and water pollution been cut but increasingly more waste water

isbeing reused. The process of the production of DAP has a high pollution potential. Phosphoric acid is produced when the mineralrock phosphate is mixed with sulphuric acid. The phosphoric acid thus producedis again mixed with ammonia gas andDAP fertiliser is ready. The potentialwater pollutants come from mainlyleakages, spillagesand washings fromthe sulphuric and phosphoric acid plantsas well as effluents from the captivepower plants.

GYPSUM: A POLLUTION HAZARD: The main water pollution concern today is the growing pile-up of gypsum (calcium sulphate) from the two industries. For every tonne of sulphuric acid produced, 5 tonnes of phospho-gypsum is generated as by-product. PPL's gypsum pond is spread over 100 hectares and IFFCO's over 70 hectares. Much of the wastewater of both industries is recycled in the gypsum slurry and settling ponds and infrastructure is in place to arrest overflow. The phosphoric acid in gypsum is corrosive to most construction materials. To prevent leeching the gypsum pond is lined with bentolite clay (PPL) or PVC (IFFCO). But heavy machinery scooping out settled gypsum damage the PVS lining and cause acid leaksPPL generates 15 lakh tonnes of drygypsum and is able to sell only a fifth of it.Its gypsum pond dykes are now 15 metreshigh and can go up to a permissible 35metres. Dry gypsum is used in the manufacturing of cement, plaster of paris and gypboards; also for amelioration of alkaline soil; Utter Pradesh is a buyer and recently the Orissa government too has announced utilisation of gypsum for this purpose.= Maintaining discarded gypsum ponds is ahigh financial burden; gypsum hillocks are a pollution hazard to which not even developed countries have found a safe solution. Being a coastal town, the area sees heavy and prolonged rainfall. The rainwater carries with it gypsum acid leaksand overflows, run-off from industry's buildings and grounds into the factories'storm water drains which discharges into Atharbanki creek and then into the Mahanadi.

Water Quality of River Brahmani and Tributary Streams Koel, Kharasrota, Aul, Sankh and Karo: The water quality of mainstream Brahmani is meeting the desired criteria with respect to pH, DO and conductivity. pH is observed in the range of 6.7-8.5. Thevalue of conductivity rangesfrom 93 ìmhos/cm to 458 ìmhos/cm. The DO value varies from 5.0 -9.9 mg/l. The BOD varies from 0.6 to 6.6 mg/l and higher values of BOD are observed at Panposh D/s (6.6 mg/l), Rourkela D/s (5.3 mg/l) and Rourkela FD/s at Biritola (3.6 mg/l) in Orissa. The Faecal Coliform (FC) count ranges from 170-35000 MPN/100ml whereas the Total Coliform (TC) count ranges from 330-92000 MPN/100ml. The higher values of TC & FC is observed at D/s Panposh (35000 MPN/100ml & 54000 MPN/100ml), Rourkela D/s (35000 MPN/100ml & 92000 MPN/100ml), Dhenkanal D/s (35000 MPN/100ml & 54000 MPN/100ml), Pattamundai (35000 MPN/100ml & 92000 MPN/100ml), Kamalanga (28000 MPN/100ml & 43000 MPN/100ml), Talcher FD/s (14000 MPN/100ml & 21000 MPN/100ml), Rourkela FD/S at Biritola (13000 MPN/100ml & 22000 MPN/100ml), Bhuban (13000 MPN/100ml & 24000\ MPN/ 100ml), Dharmashala (11000 MPN/100ml &17000MPN/ 100ml), Kabatabandha (Before Impact of Indl.Activity in Kalinganagar Area) (8400 MPN/100ml & 15000 MPN/ 100ml), U/s Panposh (7900 MPN/100ml & 13000MPN/ 100ml) and Bonaigarh (3100 MPN/100ml & 5800 MPN/ 100ml) in Orissa [86-90].

The water quality of tributary streams Koel, Kharasrota, Aul, Sankh and Karo ismeeting the desired criteria in respect of DO, pH and Conductivity. BOD isobserved in the range of 0.3-6.8 mg/l and is observed higher than the criteria inRiver Koel at Basia Dam U/s (6.8 mg/l), River Sankh at Bolba and River Karo atLohojimi U/s (6.0 mg/l) in Jharkhand. Faecal coliform (FC) and Total Coliform(TC) count is exceeding the desired water quality criteria in River Kharasrota atAul & Khanditara (D/s of Industrial Activities st Kalinga Nagar) (24000 & 35000MPN/100ml and 9400 & 14000 MPN/100ml respectively) and River Koel U/s-A/c River Karo (17000 & 35000 MPN/100ml) in Orissa.The water quality ofmainstream of River Brahmani & its tributary streams with respect toTemperature, pH, DO, Conductivity, BOD, Nitrate +Nitrite, Total Coliform.

The Effects of Rourkela Steel Plant Effluents and the Municipal Effluents on the Water Quality of River Brahmani: Huge amounts of money has been spent and some effort has been made by themunicipalities, industries and governments during the last four decades to enhance thequality of water for domestic and industrial consumption and reduce its pollution. However, very little effort if any has been made by these agencies to keep the generalpublic informed, in simple and understandable terms, as to what this vast effort andinvestment is achieving, or not achieving, in water quality enhancement. Increasingindustrialization, urbanization, agricultural production and other human activitieshave caused enormous deterioration in the quality of various natural water bodies, inparticular for India and other developing countries of Asia, Africa and Latin America.

In spite of considerable self purification capacity of river, unabated disposal ofmunicipal sewage and industrial effluents are deteriorating the quality of river water.The status of river water is very much useful as it determines the physiological lifecycle of plants, animals and human kingdom. Now a days direct use of river water fordrinking purpose bears significant problem because of the environmental hazardswhich are always associated with the development of the region. Industrial processes which consume high quality of water generally discharge wastewater containing a large number of pollutants there by causing water pollution. The integrated Rourkela Steel Plant is responsible for generating pollutants which makes their way to Guradih nallah and finally to river Brahmani. The amount ofwaste water generated in the Rourkela Steel Plant is 84,000 m3/day. The waste watergenerated from various sections of Rourkela Steel Plant is treated in primary treatment units existing in different sections. The treated water from different sectionsflows through the plant and discharge into a nallah called Guradih nallah through tennumbers of out falls. The combined water transported through this nallah is collectedin an oxidation pond known as lagoon. The water spread of the lagoon is about 52hectors with an impounding capacity of 877,500 m3 (193 gallons). The lagoon has a detention period of about 3 to 4 days at an inflow rate 7000 m3/hr. However, the present inflow rate into lagoon has reduced to about 3500 m3/hr. The effluent of lagoon joins the river Brahmani on the down stream side of Tarkera Pump house. The 64lagoon acts as a final polishing unit of total waste generated by the steel plant. Effluents from the industrial estates are also discharged to small nallahs, which finally lead to river Brahmani. Further industries like IDL Chemicals, Suidihi Distillary, Orissa Industries and other small and medium industries also contribute to water pollution in river Brahmani. Besides the industrial effluents, sewage from Steel Township, Civil Township, Fertilizer Township and other urban areas possess considerable threat to the surface water. Due to the storage of large quantities of contaminated effluent in the lagoon and dumping of large quantities of chemical slagand other wastes, the surface water and groundwater of Rourkela faces a serious threat. The survey of the quality of river Brahmani at Rourkela was conducted in the year Nov, 2001 to Oct, 2003. Two sampling stations were selected for this purpose inorder to get the baseline data on river quality. The first sampling station was selected roughly 1 km up stream (U/S) of the point where the Steel Plant effluents are discharged into the river after some preliminary treatment and mnicipal sewage without any treatment. Another sampling station was selected about 1km down stream (D/S) of the discharge point. The purpose of selecting these two sampling stations location mentioned above was to study the effect of the discharge of untreated municipal sewage and some preliminary treated industrial effluent of Rourkela Steel Plant into river Brahmani at Rourkela. Water samples were collected from these two sampling stations on a monthly basis. During the first week of each month, three grab samples were collected from each sampling stations between 7.00 AM to 9.00 AM[90].

CONCLUSION

The water pollution data on rivers, lakes, ponds, tanks and groundwater locations of river Mahanadi and Brahman in are being monitored under the network is evaluated against the water quality criteria and the monitoring locations in exceedence with respect to one or more parameters are identified. The monitoring results obtained during 2013 indicate that organic pollution continues tobe the predominant pollution of aquatic resources. The organic pollution measured interims of bio-chemical oxygen demand (BOD) & Coliform bacterial count gives the indication of extent of water quality degradation in different parts of our country 500.

Mahanadi, the longest river in Odisha, is polluted by the sewerage and biomedicakl waste from two major cities such asd sambalpur and cuttack.There are also effluents from other places like Choudwar. Similarly the river brahmani is being polluted by the effluents from Rourkela steel plant and other chemical industries in the river bed.It is concluded that much attention should be focussed by the government of Odisha and Pollution Control Board to seve the water of these two rivers being polluted day by day.

ACKNNOWLEDGEMENTS

The authors are grateful to Shri Binod Dash, Chairman, Synergy Institute of Technology for financial assistance for this project.

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