



Water Pollution in Raipur with Advancements and Urbanisation

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Abstract- With advancements in living standard the basic requirements to sustain lives has increased drastically. With increased population day by day the cost of life style is increasing. The developments and technological advancements pollutants and waste materials are being released and causing the severe pollution issue. In this paper pollution's various aspects factor responsible and control measures to prevent the environment has been reported. The population in Raipur in the year 2001 was 3,016,930 and it has increased to 4,063,872 in the year 2011. Increasing population has put the city in danger of water pollution. The reason has been identified as degree of industrialisation and generated waste, improper design of sewage exit and supply of water channel.

Keywords: - Industrial pollutants, Urbanisation, Water Pollution

I. INTRODUCTION

Addition of excess of undesirable substance to water that makes it harmful to man, animals and aquatic life or otherwise causes significant departures from the normal activities of various living communities in or around water. Water gets polluted when the normal functions and properties of water are altered. It indicates the state of deviation from the quality and purity of water sample.

In the early year of September 2009, oil slick from the **Montara oil spill** in the Timor Sea [2]. The release of liquid petroleum hydrocarbons into the environment is known as oil spill, especially in marine areas, due to the human activity. Spills may take weeks, months or years to clean up [2]. Crude oil and refined fuel spills from tanker ship by accident have damage natural ecosystems in Alaska, the Gulf of Mexico, the Galapagos Islands, France and many other places, through the oil spill at sea are damaging the lands they are spread thousands of miles in a oil slick which can cover beaches with a thin coating of oil [3]. This can kill many of sea birds, mammals, shellfish and other organisms. We have to save water and keep it clean (pure) because in Earth there is only 1% of fresh water is available.

“Alteration in physical, chemical and biological characteristics of water which may be cause harmful effects on human and aquatic bio system” The pollutants are divided into three categorize are as: - (1) Primary. (2) Secondary. (3) Tertiary pollutants. As we all know,

environment is generally divided into four segments are :- (1) Lithosphere (solid earth). (2) Hydrosphere (water component). (3) Atmosphere (gaseous envelope). (4) Biosphere.

II. FACTOR RESPONSIBLE FOR POLLUTION

There are some factors responsible for pollution are as follows:-

- Dumping of industrial waste.
- Oil pollution.
- Sewage and waste water.
- Marine dumping.
- Radioactive waste.
- Underground storage leakages
- Global warming.
- Eutrophication.

Day by day increase in population, increasing the pollution. Raipur is most polluted city in the country [1]. There is 41 villages Raipur consists [4]. The population of Raipur is approx. 1 million (GOI 2011). There are 54% commodities which are not properly designed e.g. toilets or septic-tanks/drainage system [7]. Thus results in overflow with the open drainage channels. It flows to the natural water bodies like river or reservoirs and also directly affects the ground water. It is also found that the water supply lines runs through and passes from various drainage system lying beside the supply lines. This causes the water being contaminated and causes severe diseases.

Raipur is most polluted city in the country. In Raipur many industries have been established like: - Coal, power, steel and aluminium industries. Raipur is the largest market of steel and iron in India.

- Total area of Raipur = 226 km²
- Total population in 2011= 1.1 million (11.2 lakhs) [4]
- Area covered under corporation= 142 km²
- Annual growth projected= 1.8 million (2011); 4.1 million (2041) [1,6]
- No of Industries- 146 [18]
- No of rivers flowing through Raipur region –
- Area of rivers covered –
- No of reservoirs-12 reservoirs for supplying treated water to the city.

The state of Chhattisgarh has the geographical area as per GIS about 135,100 sq km. The state is divided in to five rivers basin drain out 38,694.02 sq km. Ganga basin drain out 18,406.65 sq km. Brahmani basin drain out 1,394.55sq km and Narmada basin drains out 743.88 sq km of catchment area in the state.

Disposing the waste from different sectors are made by door to door collection of solid waste and open dump. The open dumping can be done by putting wastes in land escape or in open drainage system which goes directly to the ponds or river or dumped in pond side. The number of dumper placers and tipper trucks require for the existing population is 39 and 60 but Raipur municipal corporation (RMC) is have only (7) dumper placer and (21) tipper trucks [4], this is not sufficient for carried out solid waste from city. Due to storm is polluted the water when over all of drainage system.

In Raipur district there are approx. 40-50 ponds (talab) are there but in these day only 20-30 are left because the construction are happen and too much of solid waste dumping in ponds (talab). There is BANDHWA TALAB (pond): - in Bandhwa Talab there are 950 residents are there including small shops, temples and school. In Bandhwa talab, there are 100m³ per day solid waste or waste water is release from domestic waste water is discharge through the drainage system is about 60% [8].

In the state there is only 16% of irrigated area of the total cultivable area. As compare to other states average rainfall in Chhattisgarh [12]. Bilaspur and Raipur district possess the highest population of ruminants in the state. There are 1467 irrigation reservoirs (80760 ha) and 45, 250 villages ponds and tanks (63498 hectare).

The supply of water in Raipur city is from two sources are: - (1) Surface water. (2) Ground water. Kharoon River is the raw water source for treatment plant. There are 40 bore wells maintained by Raipur Municipal Corporation (RMC)[9]. About 20% of water supply is severed in city population to this bore wells [11]. Water treatment plant in Raipur located near Ravanbhata Water Treatment Plant for water treatment it includes coagulation flocculation, filtration and chlorination. After water filtration the chlorine gas is used for chlorination. Some-times, chlorine cylinder is not there so there is a substitute is Bleaching powder. Bleaching powder prepared in buckets and it is used for chlorination. For kill bacteria or germs of ponds or river there is chlorine is used.

In Raipur city there are not-well designed sewerage treatment system. As we say early there is open drainage system in most of the part because of this the overflow of drainage which goes to the near lake or ponds. There is one more reasons for water pollution, lakes and ponds are used for bathing, washing clothes, bathing animals (buffaloes, cows, etc.), now days the people will washing heavy trucks or car etc.

There are two reasons surface water, ground water. Ground water is the water located beneath Earth's surface in soil pore space and in the fractures of rock formation. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. There are two reasons of pollution of groundwater are as follows: - natural's reasons or due to human activities.

- Ground water is polluted from man-made products like as: - gasoline, oil, road salts and chemicals when go inside the ground water.
- There are some pesticides, fertilizers this are spread into soil for irrigation but due to this ground water will affected.
- There is again one reason as we say un-designed septic tanks.
- Through the natural point of view the particles or small particle of rock, metals or any liquid like petrol, fossil fuels etc also do ground water pollution.

Earth is called blue planet, because about 80% of its surface is covered by water, but about 97% of the earth's water resources is locked-up in the oceans and sea; which is very saline to drink and for the direct use for agriculture and industrial purpose. About 2% of water resources are locked-up in the polar ice cap and glaciers, while only about 1% is available as fresh water such as surfacewater and groundwater for human's consumption and other uses. The hydrosphere includes all type of water resources- oceans, seas, rivers, streams reservoirs, glaciers, polar ice caps and ground water. Acid rain also affects the groundwater. Acid rain occurs when oxides of nitrogen or sulphur dioxide from coal plant emissions combines with moisture presents in the air. A chemical reaction creates this acid precipitation. Acid rain can acidify and pollute lakes and other water bodies. It causes similar effect to the soil. If enough acid rain falls in a given environment, it acidifies the water or soil to a point where no life can be sustained. Plants die off. The animals that depend upon them disappear. The condition of the environment deteriorates.

III. CAUSES OF WATER POLLUTION

Water pollution is mainly caused by: -

- Natural process
- Anthropogenic process
 - Biodegradable pollutants
 - Non-biodegradable pollutants

Anthropogenic processes like industrial, agricultural, urban, domestic, radioactive, mining sources, use of pesticides and fertilizers by man etc. These pollutants are constantly discharge into the water bodies. These pollutants are responsible for deterioration of water quality that it becomes unfit for living communities.

Biodegradable pollutants are those which are decompose easily in their natural environment. These pollutants are consisting of animals, plants debris, domestic sewage

etc., and the domestic sewage help the soil like: - it gives the nutrients like carbonates, phosphates etc. that are released in the biosphere. But it will pollute the water.

Non-biodegradable pollutants are those which either do not decompose or degrade very slowly in their natural environment. These pollutants are consisting of mercury, lead salt, aluminium cans, iron, and compound like phenol compound. Mainly it effects the groundwater or surface water.

There is other factor responsible for water pollution is Eutrophication. There are two types Natural Eutrophication, Cultural Eutrophication. Natural Eutrophication the process of lake aging characterised by nutrient enrichment is called natural eutrophication. In this process oligotrophic lake is a converted into a eutrophic lake. Second type is Cultural Eutrophication this process is generally speeded up by human activities which are responsible for the addition of 80% Nitrogen and 75% phosphorus to lake and streams. The effects of eutrophication's: - during eutrophication algae blooms release toxic chemicals which kill fish, birds and other aquatic animals. The DO level falls to zero. Some bacteria derive oxygen from nitrated oxygen may last be resorted from sulphates yielding hydrogen sulphide causing foul smell and putrefied taste of water.

There are so many harmful effects of domestic and industrial waste water. Out of them few are discussed below.

- Generally domestic waste waters contain spent water, detergent waste, food material waste etc. These make water aesthetic.
- Sewage contains fermentable and oxidisable substance which reduces water oxygen and affect-aquatic flora.
- Sewage contains different kinds of pathogenic microbes such as protozoa, bacteria etc. These microbes cause cholera, typhoid, and dysentery.
- Effluents which contain acid and alkalise make the water corrosive.
- Different industries discharge their effluents in the water due to this, water change its originality in all respect such as colour, odour.
- Warm water from industrial waste heats the water body temperature where the waste water gets mixed. This heated water disturbs the aquatic ecosystem.
- Toxic effluents from pharmaceutical industries, tannic etc. can be inhibited natural purification system of water bodies.
- Chemicals like mercaptan, pentachloro phenol lower the rate of photosynthesis of aquatic flora.
- Oil discharge from different wastes interferes oxygenation process.
- The dissolved minerals increase the salinity of water due to this water may be unfit for irrigation purposes.

Discharge of domestic and industrial waste cause more problems to the receiving water body as well the ground water. Some of the impacts on water are given below.

- The water becomes unsuitable for drinking and other purpose.
- Growth of aquatic lives and fishes are affected by the presence of acids, alkalises and toxic substance.
- Presence of oil will affect the self-purification of the water body.
- Enrichment of nutrients (Eutrophication) from surrounding watershed affects the penetration of light through the water, causing damage to the characteristics of that water.
- Sewage disposed into water bodies may cause water borne infectious to the human beings.
- Disposal of coolant water used in industries increase the temperature of the surface water. This increase in temperature affects the aquatic ecosystems (thermal pollution).
- More amount nitrates in water due can cause methemoglobinemia known as blue baby.

IV. GROUND WATER POLLUTION

When deep well and shallow well water get contaminated or polluted by various sources then it is termed as ground water pollution. Sources which are responsible for ground water pollution are: -

- Waste water treatment lagoons.
- Mine spills.
- Transport accidents.
- Seepage pits.
- Urban and rural garbage's.
- Earthen septic tanks.
- Refuse dumps.
- Barnyard manures.
- Leaching and downward movement of pollution.
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Harmful Effects of Ground Water Pollution: -

Ground water pollution can causes permanent damage to soil, plants and animals including man. Some harmful effects of ground water on man and soils are discussed below.

Harmful Effects of Ground Water Pollution on Living Being: -

- Ground water pollution can cause the spread of epidemics and chronic diseases in man.
- It disease caused by polluted ground water are: - typhoid, jaundice, dysentery, diarrhoea, tuberculosis and hepatitis.
- Water contaminated by fibres cause's fatal disease such as asbestosis and lung cancer.
- Ground water in excessive rainfall areas contain iron in toxic amount as 20 mg/lit. (extremely harmful for drinking purpose as permissible limits of is only 0.3 ppm)

- The woollen industries contribute large amount of toxic metals such as Hg, Ni, Cu, Cr, Fe and cyanides to ground water. Such contaminated water can causes skin and stomach diseases in man

Harmful Effect of Ground Water Pollution on Soil: -

- The use of polluted ground water for irrigating agricultural fields severely damage crops and decreases grain production.
- Polluted water acutely affects soil fertility.
- Polluted water can kill bacteria and soil micro-organisms of soil which are essential for the fertility of soil.
- Contaminated ground water increase alkalinity in the soils.
- Ground water pollution affects plant metabolism severely and disturbs the whole ecosystem.

Protecting ground water from pollution: -

There are some following steps for the protection of ground water:

- The pollution sources should be carefully surveyed.
- Location of industrial and municipal disposal sites should be decided keeping in view the ground water levels and flow pattern in the area.
- In case of toxic industrial effluents, steps should be taken for predisposal treatment by the industry itself.
- Location of wells for drinking water supplies should be decided with most caution.
- Surrounding contaminant sources and flow directions should be considered.
- In is not advisable to tap the uppermost aquifer in case of drinking water wells.

V.SURFACE WATER POLLUTION: -

Surface water can be classified into following ways: -

- Rain water
- River water
- Lake water
- Sea water/Ocean water

Surface water should be free from the following contaminants:

- It should be free from substances which may precipitate to from objectionable deposits.
- Surface water should be free from compounds which impart colour, odour, and turbidity. So the water should be free from oils, greases, phenols, toxic metals and organic etc.
- It should free from all toxic radionuclide which affect the physiology of man, animals and aquatic organisms.
- Chlorinated compounds, chloroform and chloramines used during chlorination of surface water should not exceed the permissible dose.
- Heavy metals that affects the growth of aquatic flora and fauna.
- Substance which are likely to result in enhancing the growth of undesirable aquatic life.

- Thermal effluents should not increase the water temperature by 3 to 5° F.

Factor Affecting Surface water: -

The nature and extent of surface water pollution depends on following factor:

- Hydrological characteristic of diluting biocides and the extent of self-purification.
- Waste water disposal system and techniques for treatment of domestic and urban sewage including pre-treatment of industrial waste water.
- Physical, chemical, and biological characteristics of waste water entering the surface water.
- Hygienic and health situation of the communities residing near surface waters.
- Vegetation, soil type and degree of weathering rock.

Source of Surface Water Pollution: -

The main source of surface water pollution is as follows:

- Atmospheric gases.
- Surface Run-off.
- Industrial and Municipal Wastes.
- Agriculture Wastes.
- Decomposed Plant and Animal Matter.
- Radioactive Material

Factor Affecting Nutrient Loss in Surface Water: -

Polluted surface water is highly degraded and contains much less nutrient content. Main factors affecting nutrient loss in water are as follows: -

- Irrigation practices
- Rainfall pattern
- Topography
- Temperature and Evaporation
- Soil erosion, sedimentation and Siltation
- Nature of Vegetation Cover
- Soil Conservation practices
- Amount of run-off and percolation
- Hydrological feature of the sea.

VI. LAKE WATER POLLUTION

There are some sources which are responsible for the pollution of lake are: -

- The discharge of organic wastes for hills and toxic effluents from urban.
- Waste sludge's from factories as well as washings and dumping of tailings constitute the important sources of pollution.
- Toxic and hazardous effluents released from industries causes serious pollution of lake water which decrease the lake population considerably.
- Sewage treatment plants also contribute to toxic organic matters.
- Siltation of lakes due to dumping of enormous quantities of sediments is the main source of lake water pollution.

VII. INDUSTRIAL WASTE WATER

Industrial waste water is the waste products resulting from industrial processing operation. They include liquid, solid and gaseous water. Liquid waste adversely affects the wastes supply and sewage of towns and cities while a high amount of water is required for different industrial process, only a small fraction of it is incorporate in their products, the rest finds its way into the water course as waste product. This greatly contributes to the pollution problem. We have three alternatives for the disposal of industrial wastes: -

- The direct disposal of waste into the streams without any treatment.
- Discharge of the waste into the municipal sewers for combined treatment.
- Separate treatment of industrial wastes before discharging the same into the water bodies.
- Oil

VIII. DOMESTIC WATER (Drinking or Municipal Water)

Municipal have to supply portable water, i.e., water which is safe to drink. Drinking or portable water, fit for human consumption, should satisfy the following essential requirements: -

- It should be sparkling clear and odourless.
- It should be pleasant in taste.
- It should be perfectly cool.
- Its turbidity should not exceed 10ppm.
- It should be free from objectionable dissolved gasses like hydrogen sulphide.
- It should be free from objectionable minerals such as lead, arsenic, chromium and manganese salt.
- Its alkalinity should not be high. Its pH should be about 8.0.
- It should be reasonably soft.
- Its total dissolved solids should be less than 500 ppm.
- It should be free from disease-producing micro-organisms.

Raipur: -National Centre for Disease Control (NCDC), Delhi, has confirmed the presence of coliform bacteria, found in faces in the drinking water supply in Raipur and identified it [17].

IX. WATER POLLUTION ACT [For preventing water pollution]: -

According to World Health Organisation: - Foreign substances, either from natural or anthropogenic resources, contaminated with water supplies, may be harmful to life because of their toxicity, reduction of normal oxygen level of water, aesthetically unsuitable and spread epidemic diseases[14].

According to National Water Commission 1975: - “Water is said to be polluted if it has not been of sufficiently high quality to be useful for man in present or future [13]”

According to Dr. Bhargava 1977: -“pollution is the entry of foreign material in water to render it unfit for specific use [13]”

According to Oxford Dictionary: - “water pollution indicates the physical contamination of terrestrial and aquatic environment [15]”

“Water pollution refers to any type of aquatic contamination between two extremes”

“A body of water poisoned by toxic chemicals which presents living organisms or even excludes all forms of life [16]”

Thus water pollution not only disturbs the normal uses of water (i.e., irrigation, agriculture, industries, public health etc.) but also disturb ecological balance.

X. CLASSIFICATION OF WATER POLLUTANTS-

Certain classification has been mentioned below-

S.NO	Water Pollutants	Sources
1.	Oxygen demanding wastes	Human, animal waste, decaying vegetation
2.	Infections agents	Bacteria and viruses
3.	Organic molecules	Detergents, oil, insecticides
4.	Plant nutrients	Nitrates, phosphates.
5.	Inorganic chemical	Hg, Cd ²⁺ , Pb ²⁺ etc.
6.	Heat	Water use for cooling in industry
7.	Suspended material	Silt from land erosion
8	Radioactive substance	Fallout products, radioactive waste etc.

XI. EFFECTS ON ENVIRONMENT

There are different types of water pollution. From industrial waste in this water heavy metals and toxic are there and this are dumped in nearby lakes and rivers through this marine life such as: - fish, shellfish and it's also affect the food chain. As we say industrial waste contains toxic and heavy metal this damages the health of aquatic animals and those who eats them. From sewage there is microbial pollutants it contain so-many toxic compound this damages the health of aquatic life and terrestrial life through drinking water. As we say the word called “eutrophication” organic matter and nutrients causes an increase in aerobic algae and depletes oxygen from the water column this is known as eutrophication and its cause's suffocation of fish and other aquatic organism.

Water pollution is a major global problem. Water pollution is the worldwide cause of death and disease. About 14,000 peoples are death daily. Approx. 580 people die in India every day.

In Chhattisgarh, surface water is mostly good quality. Rivers such as Shivnath, Hasdeo, Indrāvati, Kharoon etc. these rivers are affected due to industrial, domestic and agricultural pollution. As compare to all rivers, Hasdeo River is the most polluted. Chhattisgarh Environment conservation Board (CECB) is involved in the preparation of action plan for prevention/control of pollution in streams due to discharge of sewage into the water bodies of the state. The state government has initiated the Rs.6, 000 million 'Indira Gaon Ganga Yojna' scheme. The scheme also sensitizes the communities towards the need to preserve water and avoid wastage. The river water are utilize for irrigation, urban water supply and aquaculture. The estimate surface water available for use is around 41,720 million Cubic Meter (MCM). None of the water sources are safe for drinking or bathing without conventional water treatment. The overall stage of development of groundwater is low.

Water cycle and pollution: - the circulation of water in earth, in fact, the water in the earth's biosphere is used and reused again and again. This is called water cycle or continuous movement of water between the earth and the atmosphere. It involves the following mechanism: -

- Evaporation: changing of water from liquid to gas.
- Transpiration: release of water vapour from plant leaves.
- Condensation: changing of vapour to liquid (cooled down).

Precipitation: water that returns to the earth (water droplets in clouds become large enough and there comes the rain).

XII. ESTIMATED GROUND WATER LEVEL -

Survey made for Raipur district by P.K. Pandey (Environment & Ecology) and the result has been mentioned below. The present level of ground water exploration in the state is 20% and there is a further scope for future expansion [14].

1. Assessment district – Raipur
2. Net Annual Ground Water Availability - 138949
3. Existing Gross Ground Water Draft for irrigation - 22329
4. Existing Gross Ground Water Draft for domestic and industrial water supply - 6989
5. Existing Gross Ground Water Draft for All uses – 29318
6. Allocation for domestic, and industrial requirement supply up to next 25 years – 10175
7. Net Ground Water Availability for future irrigation development – 106443
8. Stage of Ground Water Development - 25

XIII. CONTROL MEASURE TO TAKE

Following are the various preventive measures which may be adopted against the water pollution: -

- Treatment of sewage: - the sewage before discharging into the water body should be properly

treated up to such extent that it may not pollute the water.

- Treatment of industrial waste: - the industrial waste should be properly treated before disposing if off. Thus it may not cause any pollution to the water body.
- Technical facilities: - the industries should be given training and facilities to treat their sewage before discharging it.
- Water sources: - as far as possible the water sources should not be used for discharging the sewage. The sewage should be disposed of by other methods i.e. land application, burning, drying etc.
- Economic use of water: - as water is not an in exhaustive gift of the nature and, as also there is no substitute of it, other substitute and methods should be found out for the industries requiring large quantity of water.
- Administration: - water pollution control cell should be formed at state and central government level, to check the pollution of water sources.
- Funds: - the government should provide adequate funds to the public health engineering department for the construction and smooth running of sewage treatment plant.
- Legal provisions: - the treatment of the industrial sewage which may cause pollution, should be made legally compulsory, so that the concerned industries should treat their sewage before its disposal.
- Planning of new towns: - the planning of new towns, agricultural forms and industries should be done properly depending upon the availability of water sources at suitable spots, so that the sewage can be disposed of without causing any pollution of the water.
- Propaganda: - sufficient propaganda should be done to train the people against the water pollution. The public should also check up the points where there are chances of sewage pollution. The water sources should be protected against pollution by all possible means.
- Pollution Control regulations: - suitable water pollution control laws should be made and enforced. These laws should be amended from time as per requirements and advancement in the treatment technology.
- Research facilities: - research institutes should be developed at government level to do the research work in the treatment and safe disposal of sewage and prevention of water pollution. The Government of India has passed the Act, known as the water (prevention and control of pollution) Act, 1974 for the prevention, control and abatement of water pollution throughout India. In the new act provision has been made to prevent and control the water pollution jointly by state and central government. For the successful implementation of the Act, water pollution prevention Boards are set up at state and central Government levels [13].

Control of Eutrophication: - recycling of nutrients can be checked through harvest. Algae food webs should be disrupted to stimulate bacterial multiplication. Disposal of sewage and detergent wastes should not be done in lakes but should be treated.

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