The Consequence Industrial Waste on the Water Quality of Lilagar River, Paraghat Village Zone, Bilaspur (C.G.)

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Abstract:

The consequence of rapid Industrialization and fertilizers, Insecticide are uses around, the globe an unsafe water. Waste and pollutant content have become increasingly significant within effect of quality of Aquatic Ecosystem in river. Lilagar river water is one of the major sources for multipurpose domestic uses may part of Para ghat, Jayram Nagar, Kotmi Sonar village area. The present investigation deals with a study of chemical parameters, pollutant studies have in this river on different eight sites by a specially prepared. Aquatic assessment questionnaire chemicals & inorganic matter and content of BOD, COD and other biotic abiotic activities. Water quality and various physio-chemical Analysis of river surface water of Different eight (8) sites of Para ghat, Jayram Nagar, Kotmi Sonar village zone Bilaspur, C.G. has studies in over a period of three months (Oct.-Dec.2024) after monsoon. Reading have observed to analysis different physio-chemical parameters – pH, Turbidity, Total Hardness, TDS, COD and BOD, the results are found in the range of 7.0-7.4 pH, 1.6-2.2 NTU, 210-240 mg/l, 240-260 mg/1, 10.1-11.5 mg/l and 2.5-3.8 BOD value. Respectively while Redox Potential, Zn, Fe, CI, Conductivity and Bacterial E. Coliform are in the range of 300-330 Mv, 1.4-2.2 mg/l, 0.07-0.12 mg/l, 160-190 mg/l, 300-425 μs/cm and 0.01-0.03 MPN/100ml. The present study has it's almost importance for hygienic point of view in the Public Interest and its consequence with respect to health hazard. village zone was selected for the purpose of Investigation many illiterate villagers and use of surface river water for their aware of pollutant adverse consequence, drinking purpose & domestic activity.

Keywords: Public Health; Aquatic Environment; River; Water parameters

1. Introduction

The rivers are the most dynamic of the earth's ecosystems, their major function being the transportation of water. They also carry to the river, dissolved and particulate matter of organic and inorganic Ions. Water is the second most important need for life to exist. The most popular definition of water quality it is the physical, chemical, and biological characteristics, parameters quality is a measure of the condition of water relative to the requirements of more biotic species to aquatic and human life purpose [8]. River, a vital

waterway in the Geological Environment our Country, has historically supported diverse ecological systems and provided essential resources for local communities. However, in recent decades, rapid industrialization has led to a significant degradation of water quality, raising serious environmental and public health concerns. The river is now facing unprecedented levels of pollution from industrial activities, threatening both its ecological integrity and the well-being of the population that depends on it. Industrial discharges, characterized by a variety of toxic and pollutant substances, have been identified as the primary source of pollution in the river surface water. These contaminants include metallic ions such as lead, manganese and iron, as well as organic and inorganic pollutants like industrial solvents, pesticides and dyes [12]. The presence of these physio chemical and pollutant substances in the river has far-reaching implications, impacting aquatic life, human health, and the overall sustainability of the region's water resources. The river water of effective industrial waste management and insufficient regulatory oversight has exacerbated the pollution problem. Many Steel, Iron, Plastic, Fertilizer, Argo bios, Dairy, Coal and Ciment industries discharge untreated or inadequately treated effluents directly into the river, resulting in the accumulation of harmful substances in the water and sediment [6]. The contamination not only threatens the aquatic ecosystem but also poses serious health risks to humans who depend on the river for drinking water, irrigation, and fishing. Previous literature studies have documented instances of waste pollution in the river water however, comprehensive data on the types and concentrations of industrial waste and their impacts remain limited for aquatic life cycle and waterborne illness health hazardous.

2. Objective

This study aims to systematically analysing the river water for a range of consequence waste pollutants and assessing the environmental and health implications of the contamination.

The objectives of this study are threefold

1. Identification and Quantification of Pollutants - To identify the major industrial pollutants present in the river and quantify their concentrations.
2. Source Attribution - Focusing on the industrial waste contributing to the contamination.
3. Impact Assessment - To evaluate the ecological and human health impacts of the detected pollutants, emphasizing the effects on aquatic life and the local population.

Location of Sampling Sites

The Lilagar River flows through the Bilaspur district in the state of Chhattisgarh (C.G.), India. Para Ghat, Kotmi Sonar and Jairam Nagar are locations situated along this river. To provide precise geographical information, a site illustrating the location of these places along the river is useful.

Geographical Context

Para Ghat (In Both Sites River)

Coordinates: Approximately 22.02812° latitude and 82.3307° longitude.

Significance: A small village near the Lilagar River, known for agricultural and fishing activities.

Kotmi Sonar (In Both Sites River)

Coordinates: Approximately 22.02236° latitude and 82.33086° longitude.

Significance: A small village near the Lilagar River, known for agricultural and domestic activities.

Jairam Nagar (In Both Sites River)

Coordinates: Approximately 22.02634° latitude and 82.33056° longitude.

Significance: Another village along the river, Jairam Nagar is a known local point for community activities and farming.

The Lilagar River is a tributary Eastern area of the Arpa and Hasdeo River, which itself is a tributary of the Mahanadi River. The river basin supports local agriculture and provides water for various domestic uses. The region is characterized by a mixture of rural and semi-urban settlements with an economy largely based on agriculture. To view a detailed sites one can use of photograph platforms searching for "Lilagar River, Para Ghat, Kotmi Sonar and Jairam Nagar Chhattisgarh." Alternatively, a GIS application can provide a more longitude and latitude. This site will assist in understanding the geographical relationship between the Lilagar River and the villages of Para Ghat, Kotmi Sonar and Jairam Nagar, thereby supporting research, planning, and management activities in the region. The Lilagar River flows through the region near Para Ghat, Kotmi Sonar and Jairam Nagar in Chhattisgarh India. located sites distance 15-22 km from Bilaspur C.G., is a notable point along the river. This area is accessible via the railway station at Jairam Nagar and Kotmi Sonar, which is historically and biological significant.

3. Review of Literature

Structured review of literature on the impact of industrial waste is the most dreadful issue recently. It declines soil, air and water quality that affects human health. The speedy industrial growth has induced a rapid increase in the environmental problems around the world especially rural and urban area. Various studies have documented the adverse effects of industrial effluents on the river's water quality, aquatic life, and surrounding communities. Several literature studies have identified major sources of pollution impact in a River water, primarily from nearby industrial activities, including - Chemical Plants, Steel, Spong, Fabric Industries, Release of dyes and other hazardous chemicals into the river. Disposal of mining waste and runoff containing high levels of pollutant substances such as iron and Lead, Manganese. Physico-chemical Parameters as Elevated levels of BOD, COD, TDS Conductance and potential of redox., concentrations of heavy metals, Presence of coliform bacteria., Ecological Impact Notable effects include., affecting reproductive and survival rates aquatic life. Bioaccumulation Heavy metals in aquatic organisms, posing risks to higher trophic levels and human consumers and pollutant substances in river water have led to reduced growth and health of riparian vegetation, affecting overall ecosystem stability.

4. Methodology

To assess the domestic industrial, waste and pollutant upshot in Lilagar River water, a comprehensive and systematic methodology is used in standard (WHO, ISI) applied. involves several key steps, sampling, laboratory analysis, data interpretation, and reporting. Here's a detailed outline of prescribed standard process:

Sampling

Sites Selection - Choose strategic eight points along the Lilagar River, including upstream (control), midstream (near industrial discharge points), and downstream locations. Sample collection quarterly timing after monsoon Oct-Dec 2024 year.

Sample Collection and Tested

Containers Use clean, sterilized bottle containers 2 litter made of high-density polyethylene and Preserve samples as per standard methods adding preservatives like 2N nitric acid inorganic metal analysis, physical and chemical biological parameters. Preserve sample tested of all physio chemical parameters by prescribed standard method are below.

Table No. 1 Methods Use for Evaluated of Various Parameters According to WHO and BIS 2012.

S. No.	Parameter	Applied Method
1.	pH	pH Meter (Systronic)
2.	Turbidity	Nephelo Turbidity Meter (Systronic)
3.	Total hardness	Complexo-Metric titration
4.	TDS	TDS Meter
5.	BOD, COD	Incubation & Titration Method
6.	Redox Potential	Potentio Metrically
7.	Zn, Fe	Volumetric & Spectrophotometer
8.	Cl	Silver nitrate method
9.	Conductivity	Conductometer (Systronic)
10.	Bacterial Count Coliform	Microscopic Method

Sample Collection Point Lilagar River, Bilaspur, Chhattisgarh
Latitude 22.02812º – Longitude 82.3307º

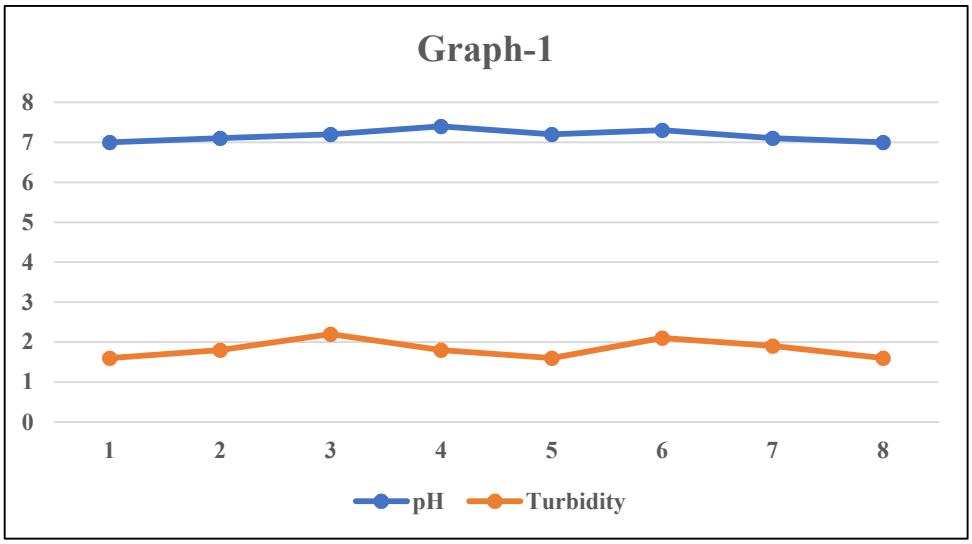
Map of Chhattisgarh

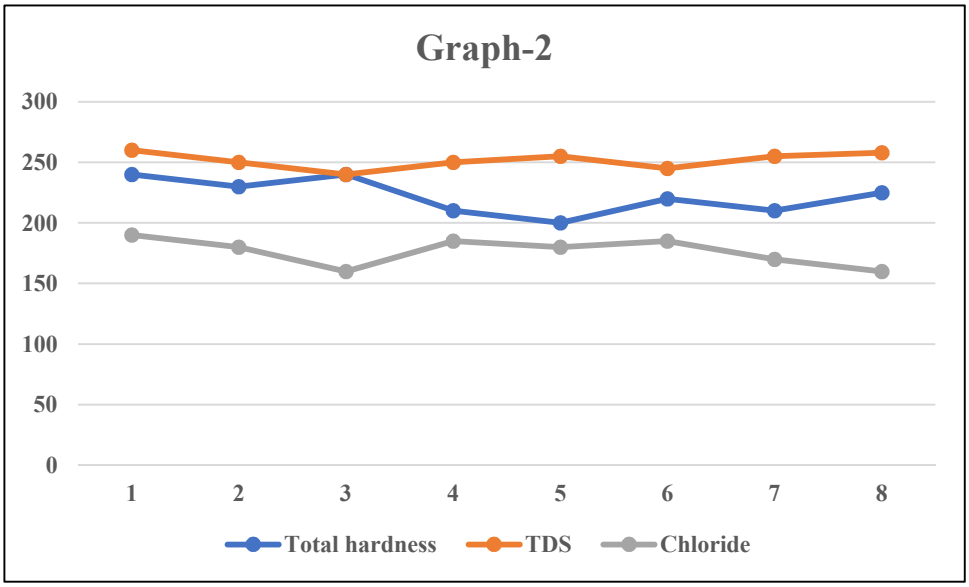
Table No. – 02 Result of different parameters.

Parameter	Permissible Limit WHO, BIS 2012,2015	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5	Sample No. 6	Sample No. 7	Sample No. 8
pH	6.5-8.5	7	7.1	7.2	7.4	7.2	7.3	7.1	7
Turbidity	5 NTU	1.6	1.8	2.2	1.8	1.6	2.1	1.9	1.6
Total hardness	500 mg/l	240	230	240	210	200	220	210	225
TDS	500 mg/l	260	250	240	250	255	245	255	258
BOD	5.0 mg/l	3.2	3.8	3.6	3.1	3.6	3.5	2.5	2.9
COD	50 mg/l	10.2	10.8	10.8	11.5	11.2	10.1	10.6	10.3
Redox Potential	600 mv	330	320	310	300	320	310	330	305
Zinc	5.0 mg/l	1.4	1.8	2	1.6	1.8	2.2	1.9	2
Iron	0.3 mg/l	0.08	0.07	0.09	0.08	0.1	0.12	0.07	0.09
Chloride	250 mg/l	190	180	160	185	180	185	170	160
Conductivity	0-200 μS/cm	300	325	400	425	375	400	310	340
Bacterial Count Coliform	1-10 MPN/100 ml	0.01	0.02	0.01	0.02	0.01	0.03	0.01	0.02

5. Results

Graphs




Graph-2
300
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3
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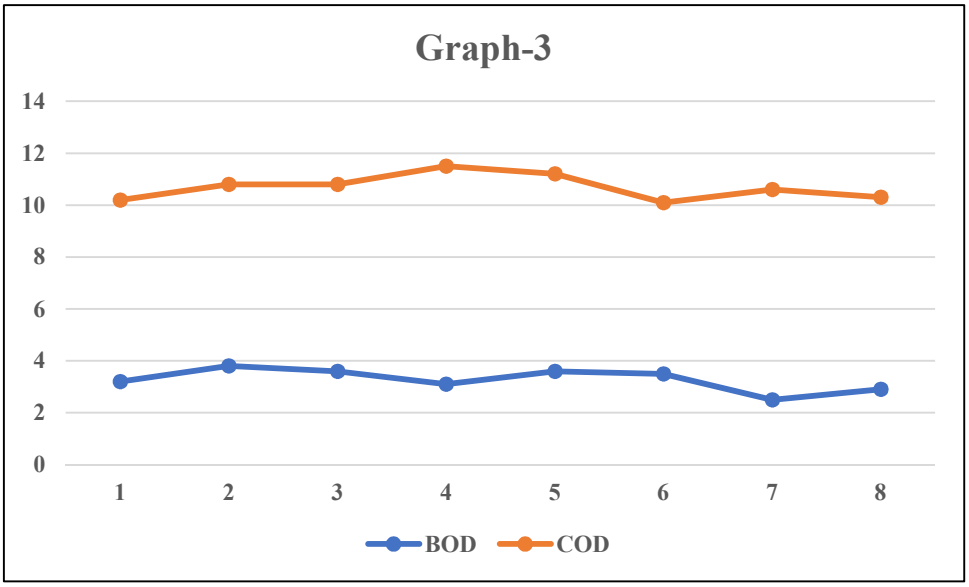
Total hardness
TDS
Chloride


Graph-3
14
12
10
8
6
4
2
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3
4
5
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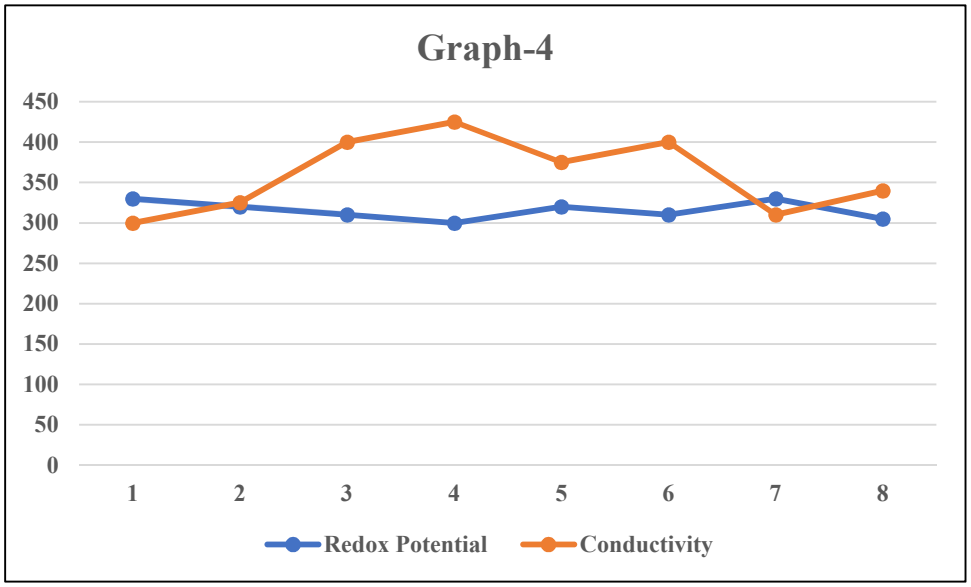
7
8
BOD
COD


Graph-4
450
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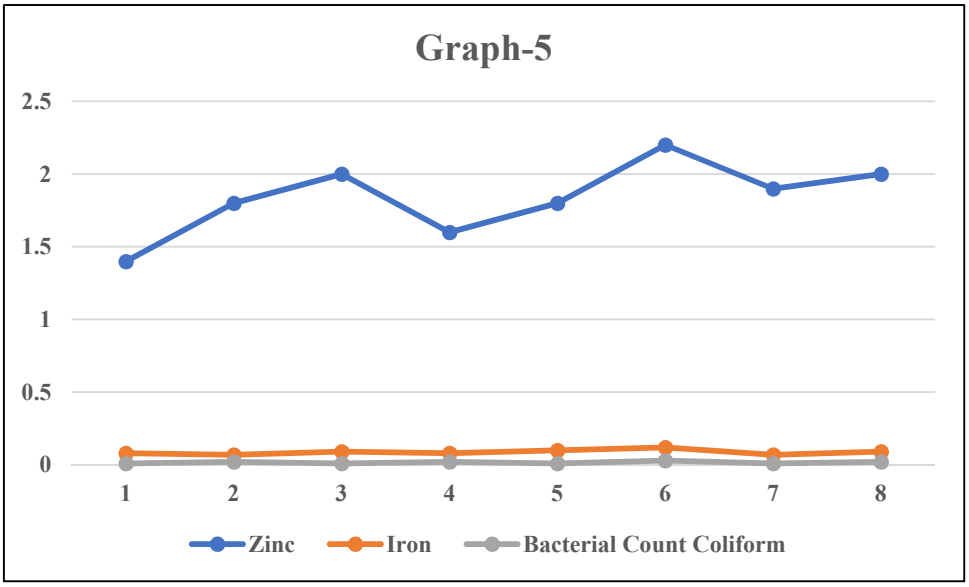
Redox Potential
Conductivity



6. Discussion

For proper understanding of our environment, we must have a clear idea of the identities and quantities of pollutants and other industrial waste chemical species in river water**.** Hence aquatic environment depends heavily on reliable techniques which can meet the challenging problems of environmental chemical analysis. For example, public, aquatic health, pollutant analysis is required to monitor industrial waste, pollutant and ionic metals as Zn, Fe, in surface river water. The public health concern low or arises from the fact that though the normal daily metal and pollutant intake from surface river water may not appear.

Discussion Parameters are below -

pH:

In our investigation pH range was noted 7.0- 7.4, In all sampling spot pH value equal in nature water ecosystem. which is under the range of acceptable for domestic and irrigation suggest by WHO and ISI.

Turbidity: It was detected range 1.6 – 2.2 (NTU), which is within acceptable limit.

Total Hardness:

Total hardness is equal some of temporary and permanent hardness. The range of 210-240 (mg/l), the source of hardness of surface water is main due to dissolve of OH, HCO_3, Cl and So_4 ion of Ca, Mg, Fe and Zn., acceptable value of Above reading according to WHO (2012).

TDS

Total dissolve solid is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro granular suspended form [Dwivedi P. Rani, Augur M.R. Agrawal Anita (2014)]. The permissible limit of TDS of surface water is 240-260 mg/l, which is within the permissible limit (ISI 2012).

BOD

BOD is the measure of the degradable organic material present in water sample and can be defined as the amount of O_2 required by the microorganisms in stabilizing the biological degradable organic matter under aerobic conditions. BOD is measured by incubating sample at 27^o C for three days. BOD value observed on 2.5 mg/l – 3.8 mg/l. all eight different sampling sites comparatively BOD value below the permissible limit prescribed ISI 2012.

COD: The ranking value from were obtained eight sample 10.1 mg/l – 11.5 mg/l.

Redox Potential

R. P. value is obtained under 300-330 Mv., is good potential for Aquatic ecosystem and living being. Diagnostic for determining whether an area is functioning as wetland or no wetland. Oxidation and reduction reactions regulate many of the biogeochemical reactions in surface environments. Redox potential (MV) is determined from the concentration of oxidants and reductants in the environment. Redox potential [also known as oxidation / reduction potential (ORP)] is a measure of the tendency of a chemical species to acquire electrons or lose electrons to an electrode and thereby be reduced or oxidised respectively. Redox potential is expressed in MV.

Zinc (Zn)

It is an essential and beneficial element for human health and aquatic ecosystem (A.k.de.). In surface river water values of zinc in obtained 1.4 mg/l – 2.2 mg/l. This value located permissible limit.

Iron (Fe)

Iron is a Surface water generally content in a colloidal state, that may be peptides by organic metal complexes or in relatively coarse suspended particles. The analysis obtained value 0.07 mg/l – 0.12 mg/l in a located sample site. According to WHO 2012 permissible limit.

Chloride (Cl)

The potentially of Cl^- in microbes killing is depended upon the pH and people accustomed to higher chloride in surface water are subjected to laxative effect. In our assessment value the range of 160-190 mg/l belong acceptable limit according to WHO.

Conductivity

Eight sampling sites conductivity value observe 300-425 μs/cm., conductivity measures how easily electricity flows through water. Just like metal ions, free moved dissolved particles water can conduct (transport) electricity.

Bacterial E. Coliform

The bacteriological quality of water is generally expressed in terms of the parameters: E. coli and total bacteria. These are important water quality parameters from public health viewpoint since they play key roles in water-borne diseases, Coliform bacteria are organisms present in the environment and in the faces of all warm-blooded animals and humans. Coliform bacteria will not likely cause illness. However, their presence in drinking water indicates that disease-causing organisms (pathogens) could be in

the water system. Observe value is not affected human and public health from Lilagar river, (Value is 0.01 - 0.03 MPN/100ml).

7. Conclusion

Elevated resultant all parameters maximum permissible limit indicated but is known, Lilagar River's health is critically impacted by industrial waste pollutants, posing serious risks to both the ecosystem and human populations dependent on it. Addressing these challenges requires a comprehensive approach involving regulation, advanced technologies, community engagement, and sustainable practices. By implementing effective mitigation strategies, it is possible to reduce the industrial waste and restore the health and vitality of the Lilagar River. The analysis of the Lilagar River water reveals significant contamination due to industrial activities. Our findings indicate elevated levels of metallic ion, chemical pollutants, and organic contaminants, surpassing the permissible limits set by environmental regulations. These pollutants pose serious risks to the aquatic ecosystem, public health, and local agriculture activities. Microbial Contamination if Increased levels of coliform bacteria indicate the presence of sewage and organic waste, posing further health risks to the communities relying on the river for water. The cumulative effect of these pollutants not only degrades the water quality but also threatens biodiversity, agricultural productivity, and the well-being of local populations. Immediate remedial actions are necessary, including stringent monitoring, improved waste management practices, and implementation of sustainable industrial processes. Collaborative efforts among governmental bodies, industries, and local communities are crucial to restore and protect the Lilagar River from further degradation. This pollution not only degrades the water quality but also disrupts the river's ecological balance, leading to a decline in biodiversity and adverse effects on aquatic organisms. The local communities, who rely on the river for drinking water, agriculture, bathing and domestic use are particularly vulnerable to the effects of this pollution. There have been increasing reports of health issues linked to water contamination, including gastrointestinal diseases, skin disorders, and heavy metal poisoning. The socio-economic impact is also significant, as declining water quality affects agricultural productivity and fishery resources.

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