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Water quality assessment of Sone river at Amlai and Chachai bank in Winter Season

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Abstract

A crucial component of environmental and public health is water quality. For human consumption, aquatic ecosystems, agriculture, and industrial activities, clean, safe water must be readily available. Millions of people depend on the Son River, one of India's major rivers, for their lives and the health of their ecosystems. However, growing anthropogenic activity and pollution sources have stoked worries about the Son River's water quality. The purpose of this research paper is to examine the current water quality in winter, the variables that affect it, the effects of low water quality on different industries, and long-term solutions to water quality problems. This research report intends to evaluate the Son River's current water quality status, identify the major problems encountered, and provide feasible ways to enhance and maintain its water quality.

Introduction

All living things require water as a basic resource, and it is essential to maintaining life on Earth. Water's chemical, physical, biological, and microbiological qualities, which influence its acceptability for particular uses, are referred to as its quality **[1-10]**. To assure the safety and suitability of water for diverse uses, including drinking, irrigation, recreational activities, and ecological balance, water quality assessment entails the examination of these criteria **[11-12]**. Human activities have had a big impact on water quality throughout history **[13-14]**. Heavy metals, minerals, diseases, pesticides, and new contaminants have been found in water bodies as a result of industrialization, urbanisation, intensive agriculture, and poor waste management practises **[15-16]**. These contaminants have the potential to harm aquatic ecosystems, agriculture, the economy, and human health **[17]**. This study paper's goal is to provide a thorough analysis of water quality, with a focus on the assessment techniques, the variables that affect water quality, the effects of low water quality on various industries, and long-term approaches to managing water quality **[18-19]**. Policymakers, scientists, and communities may make well-informed decisions and put into place practical solutions to preserve clean and safe water supplies by being aware of the issues and potential solutions **[20-23]**.

Review the methods and parameters used to measure the physical, chemical, biological, and microbiological components of water. Investigate the variables that affect water quality, such as point source and non-point source pollution, agricultural methods, industrial processes, urbanisation, and climate change **[24]**. Analyse how poor water quality affects industrial processes, agriculture, aquatic ecosystems, and human health. You should also consider the financial effects **[25]**. Provide environmentally friendly techniques to managing water quality, such as water treatment technology, watershed management plans, legislative measures, public awareness campaigns, and water conservation tactics **[26]**. Examine case studies of locales with problematic water quality, highlighting successful approaches and takeaways **[27]**. Discuss emerging trends in technology, coping with climate change, implementing new policies, and managing integrated water resources as they relate to managing water quality **[28]**. By focusing on these goals, this research paper hopes to advance knowledge and understanding of water quality problems, encourage sustainable water management methods, and aid in the creation of policies and strategies that will ensure that present and future generations have access to clean and safe water resources **[29-30]**.

4. Methodology

4.1 Study area

One of the longest rivers in India is the Son River, often referred to as the Sone River. It travels through the states of Madhya Pradesh, Chhattisgarh, Jharkhand, and Bihar and is a tributary of the Ganges River. Before joining the Ganges at Patna, Bihar, the river travels a distance of about 780 kilometres (485 miles) from its source in the Maikal Range of hills in Madhya Pradesh. For its importance in India's religious and cultural environment, the Son River is well-known. Hindus regard it as sacred, and on its banks, several religious events and rituals are carried out.

The river is economically significant since it helps many communities' livelihoods by supporting agricultural activities along its path. Due to the abundance of natural resources, mainly coal, in the Son River basin, mining activities have been established there. However, industrial activity have also added to the river's pollution, causing problems for the ecosystem's ecological health. A prominent waterway in the area, the Son River is used to move both people and commodities. It is also a well-liked river tourism site, drawing tourists who want to discover its natural beauty and cultural legacy.

Figure 1:

4.2 Collection of samples

The water is collected at 22.01.2021 from the Son river in Amlai and Chachai bank, Shahdol, Madhya Pradesh, India. Some results will be recorded in the laboratory of Orient papers Mills.

Table 1: Sampling methodology and preservation

Parameters	Containers	Preservation condition	Volume	Maximum preservation duration
Temperature	Plastic or Glass	-	1000 mL and 25 gm	Analyse immediately
pH	Plastic or Glass	-	25 mL and 25 gm	Analyse immediately
Turbidity	Plastic or Glass	-	100 mL	28 days
Chloride	Plastic or Glass	-	300 mL	6 months
TDS	Glass	-	300 mL	Analyse immediately
BOD	Plastic or Glass	4^0C	1000	48 hours

5. Result and discussion

5.1 Water Quality Assessment

Assessing the water's quality entails systematically evaluating a number of factors to ascertain its chemical, physical, biological, and microbiological features. This assessment helps detect potential threats to human health and ecosystems as well as useful information about how suitable water is for various uses.

5.1.1 Physical Parameters

Temperature, turbidity, colour, odour, and conductivity are a few of the basic metrics that characterise the physical characteristics of water. These variables shed light on the general look, clarity, and sensory qualities of the water.

- **Temperature:** The temperature of the water can be used to determine if it is thermally suitable for aquatic life and to detect the presence of thermal pollution sources such as industrial discharges.
- **Turbidity:** Water that has suspended particles causes turbidity, which is a measurement of cloudiness or haziness. The growth of aquatic plants, light penetration, and aquatic creature health can all be impacted by high turbidity levels.
- **Colour:** The presence of natural organic matter or the leaching of contaminants like metals, tannins, or industrial wastes can be indicated by the colour of the water.
- **Odor:** Odd or unpleasant odours in water could be a sign of microbial contamination or the presence of organic substances.
- **Conductivity:** Conductivity, which is affected by dissolved salts and minerals, gauges the water's capacity to carry an electric current. It can offer information about salt levels and possible pollution.

5.1.2 Chemical Parameters

Chemical parameters measure the quantity and composition of different chemicals in water. These variables aid in locating potential contaminants and figuring out the general chemical make-up of water.

- **pH:** Water's pH, which shows how acidic or alkaline it is, is a crucial factor for aquatic life. Aquatic creatures can be harmed by pH extremes.
- **Chloride:** An indicator of the water's quality and probable contamination sources is the concentration of chloride (Cl-), a common ion. The Central Pollution Control Board (CPCB) in India has not established any precise criteria for chloride in river water. However, unless there are considerable anthropogenic inputs or industrial discharges, it is generally believed that the concentration of chloride in river water will be within natural background levels. Internationally, a number of organisations offer recommendations for the amount of chloride in water. To avoid concerns with taste and odour, the World Health Organisation (WHO) and United States Environmental Protection Agency (EPA) suggests a maximum chloride concentration of 250 mg/L in drinking water. The chloride of Son river near Amlai and Chachai are 414.18 and 83.75 mg/L respectively. In Amlai area, chloride level is very high.

Biochemical Oxygen Demands (BOD):

BOD levels are essential for aquatic creature viability. Hypoxia brought on by low BOD levels can be harmful to fish and other aquatic life. The Central Pollution Control Board (CPCB) in India has established the following BOD standards for different water bodies with specified best use classes. Without treatment, a drinking water source's BOD shouldn't be more than 2 mg/L. When bathing outside, BOD shouldn't be more than 3 mg/L. Fisheries and wildlife reproduction: BOD shouldn't be more than 3 mg/L. BOD should not exceed 6 mg/L during irrigation. The BOD of Son river near Amlai and Chachai are 0.4 and 18 mg/L respectively. In Chachai area, BOD is very high due to water pollutants.

Chemical Oxygen demand (COD):

An indicator of the overall organic and oxidizable pollutant load, COD measures the quantity of oxygen needed to chemically oxidise both organic and inorganic components in water. The Central Pollution Control Board (CPCB) in India has established the following COD standards for different water bodies with specified best use classes. Without treatment, a drinking water source's COD shouldn't be more than 10 mg/L. When bathing outside, COD shouldn't be more than 10 mg/L. Fisheries and wildlife reproduction: COD shouldn't be more than 30 mg/L. COD should not exceed 50 mg/L during irrigation. The COD of Son River near Amlai and Chachai are 25 and 120 mg/L respectively. In Chachai area, COD is very high due to water pollutants.

Table 2: Amlai bank of Son River

SN	Characteristic	Unit	A	B	C	D
1	Temperature	ºC	24	24.5	24.2	24.2
2	Appearance	-	Clear	Clear	Clear	Clear
3	Colour	-	Colorless	Colorless	Colorless	Colorless
4	Odour	-	Odourless	Odourless	Odourless	Odourless
5	pH	-	7.7	7.97	7.8	7.82
6	Total Solids	mg/L	511	595	651	632
7	Total Dissolved solids	mg/L	490	569	627	610
8	Suspended Solids	mg/L	21	26	24	22
9	Chloride	mg/L	414.8	409.8	378.4	444.8
10	BOD	mg/L	0.4	0.3	0.2	0.3
11	COD	mg/L	25	20	30	40

Table 3: Chachai bank of Son River

SN	Characteristic	Unit	A	B
1	Temperature	ºC	24	24.1
2	Appearance	-	Clear	Clear
3	Colour	-	Colorless	Colorless
4	Odour	-	SI Unplesent	SI Unplesent
5	pH	-	7.35	7.38
6	Total Solids	mg/L	311	331
7	Total Dissolved solids	mg/L	290	312
8	Suspended Solids	mg/L	21	19
9	Chloride	mg/L	83.75	73.90
10	BOD	mg/L	18	14
11	COD	mg/L	120	90.0

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5.2 Discussion

In this research, reveal that there are several parameters exceeds the normal level. The chloride level in Amlai bank of son river is concern for water quality shown in **Figure 2**. High chloride levels in the water of the Amlai area could be caused by several factors, most of which are related to human activities and natural processes. Chloride is a common ion that can be found in water due to various sources. Here are some potential reasons for the elevated chloride levels: industrial discharges, municipal wastewater and agricultural practices.

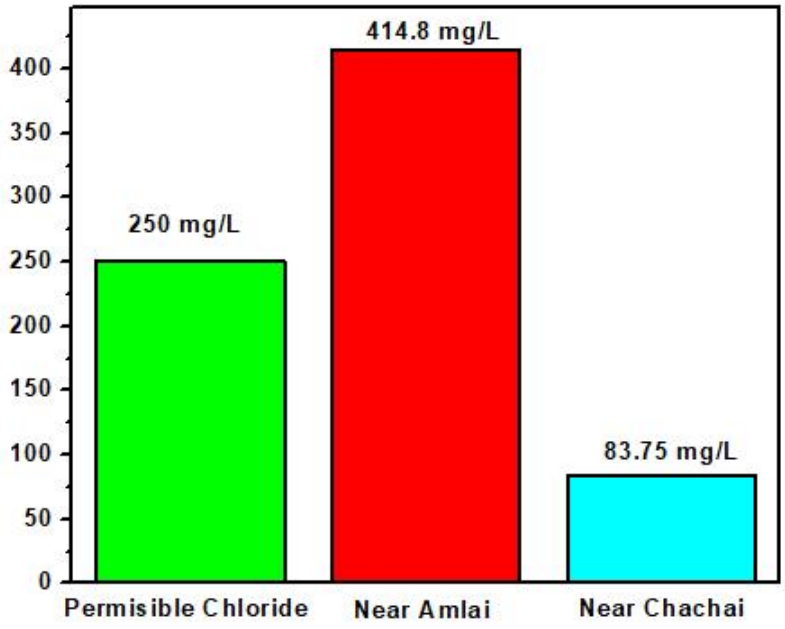

Figure 2: Chloride level in Amlai and Chacahi

The BOD and COD in Chachai bank of son river are very high than that of normal level shown in **Figure 3** and **4**. The high levels of BOD and COD in the Chachai bank of the Son River could be attributed to various factors related to pollution and environmental degradation. Both BOD and COD are indicators of water pollution and the organic content present in water bodies. Here are some possible reasons for the elevated BOD and COD levels, like industrial discharges, domestic sewage, agricultural runoff and and soil erosion.

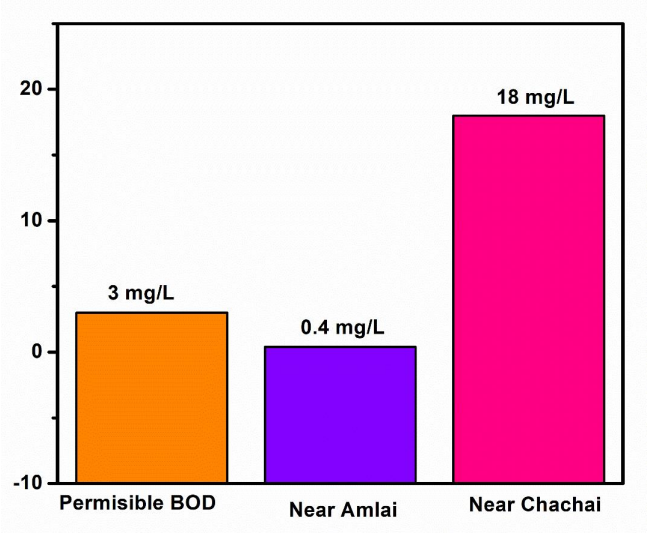

Figure 3: BOD level in Amlai and Chacahi

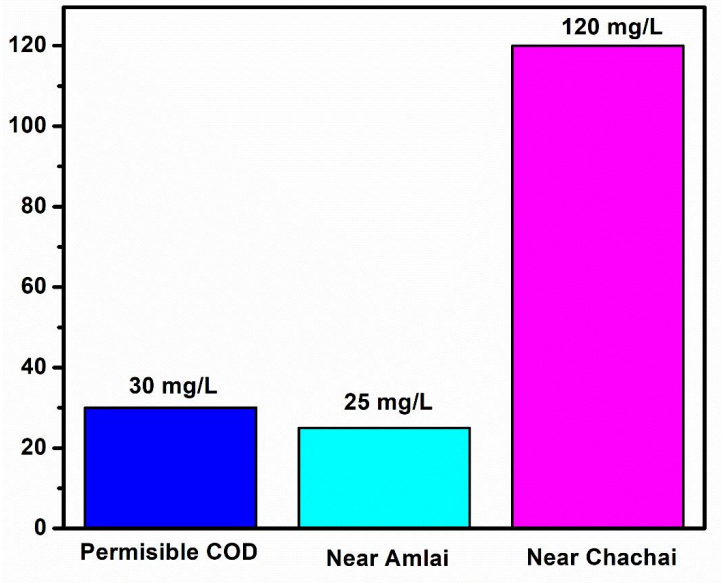

Figure 4: COD level in Amlai and Chacahi

Conclusion

This research paper offers a thorough review of the assessment of water quality, the elements impacting water quality, the effects of poor water quality on various sectors, and sustainable methods for efficient management of water quality. In the winter season, elevated chloride levels observed in the Amlai area along the Son River are a cause for concern. This increase can potentially be attributed to various factors including industrial discharges, the release of municipal wastewater, and certain agricultural activities. In the winter season, BOD and COD level is very high in Chachai bank of Son River which is harmful for aquatic and human. There are several potential explanations for the heightened levels of BOD and COD in the area, including the discharge of industrial effluents, untreated domestic sewage, runoff from agricultural activities, and erosion of soil. The results highlight the significance of coordinated efforts by governments, businesses, communities, and people to protect water resources and guarantee a sustainable and healthy future. To solve the issues caused by declining water quality and achieve long-term water security, more study and funding for novel technologies and policies is needed.

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