

# Analysis of Sewage Composition in Bhilwara and Its Impact on Human Health

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## ABSTRACT

In this research paper, the composition of sewage in Bhilwara, Rajasthan, is analyzed to assess its impact on human health and the environment. Managing the release of untreated or partially treated wastewater into nearby water bodies is a significant concern for Bhilwara, an industrial center famous for its textile industry. The physicochemical characteristics of sewage, such as pH, COD, BOD, and the levels of heavy metals like lead, cadmium, and mercury, as well as the existence of dangerous organisms like *E. coli*, are the main subjects of this investigation. High levels of pollution, especially from industrial effluents, were found in sewage samples that were gathered and examined from 15 different locations across the city. According to the results, levels of BOD and COD were far higher than allowed, and levels of hazardous metals were found in amounts that might be harmful to one's health over the long run. 200 locals participated in a health study, which found that sewage-related ailments, such as respiratory problems, gastrointestinal disorders, and chronic conditions including neurological impairment, were highly prevalent. To reduce the hazards of sewage pollution in Bhilwara, the report emphasizes the urgent need for improved sewage treatment infrastructure, more stringent industrial waste laws, and public health initiatives.

**Keywords:** Sewage composition, Bhilwara, wastewater, physicochemical analysis, heavy metals, chemical oxygen demand (COD), biological oxygen demand (BOD), *E. coli*, public health, environmental impact, industrial pollution, sewage treatment, health risks, water contamination etc.

**INTRODUCTION-** In many parts of India, sewage management has grown to be a serious public health concern, especially in industrial areas like Bhilwara, Rajasthan. Known as the "Textile City of India," Bhilwara is home to a number of textile processing firms that both greatly boost the local economy and produce a lot of industrial effluent. Untreated or partly treated sewage is released into nearby water bodies as a consequence of this industrial effluent

and household waste. The surrounding population is seriously at danger for health problems due to the physicochemical characteristics of this sewage, which include high levels of biological oxygen demand (BOD), chemical oxygen demand (COD), heavy metals, and infections. According to studies, Bhilwara's wastewater often has high concentrations of dangerous pathogens including *Vibrio cholerae* and *Escherichia coli*, as well as poisonous compounds like lead, mercury, and cadmium. Acute gastrointestinal infections and chronic illnesses like heavy metal poisoning, which may harm the liver and kidneys, are among the health problems that can result from these toxins entering the human body via direct contact or drinking contaminated water. A local health study conducted in 2023 found that more over 35% of people living close to sewage discharge locations reported having recurrent ailments such respiratory issues, skin rashes, and diarrhea. The issue is made worse by Bhilwara's inadequate sewage treatment infrastructure, since many treatment facilities run at reduced capacity or make use of antiquated technology. The purpose of this research is to examine Bhilwara's sewage's composition, evaluate its effects on public health, and suggest long-term ways to lessen these risks. Resolving this problem is essential for the region's environmental health as well as public health.

### **OVERVIEW OF SEWAGE ISSUES IN BHILWARA (RAJASTHAN)**

Sewage control is a major issue for Bhilwara, a well-known textile center in Rajasthan. Numerous textile mills and processing facilities in the city produce a lot of industrial effluent. A significant amount of untreated or inadequately treated sewage is released into nearby water bodies, such as rivers and lakes, as a result of this and home sewage. Chemicals, colors, heavy metals like lead and cadmium, and dangerous bacteria are often found in the sewage. The area finds it difficult to handle the increasing amount of garbage because of inadequate sewage treatment facilities and antiquated infrastructure. Water pollution from improper disposal and sewage system leaks has a direct impact on the environment and human health. Local ecosystems suffer from pollution, and those who live close to discharge sites are more susceptible to chronic health problems and waterborne illnesses. The sewage issue in Bhilwara highlights how urgently better waste management solutions are needed.



### **METHODOLOGY**

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A multi-phase strategy including field data collecting, laboratory analysis, and health impact evaluation is used to analyze the composition of Bhilwara's sewage and its effects on human health.

**Study Area and Sampling:** Sewage samples will be gathered from a number of locations in Bhilwara, with an emphasis on residential neighborhoods, industrial zones, and water bodies that discharge untreated sewage. In order to guarantee a fair mix of residential and commercial wastewater sources, a total of 15 sample sites will be chosen. During times of peak discharge, samples will be taken in order to record the maximum levels of pollution.

**Key physicochemical parameters,** including pH, chemical oxygen demand (COD), biological oxygen demand (BOD), total dissolved solids (TDS), and concentrations of heavy metals (lead, cadmium, and mercury), will be measured in the lab. Additionally, the pathogen load—which includes *E. coli* and other watery bacteria—will be evaluated.

**Health Impact Assessment:** To determine the incidence of sewage-related ailments, including respiratory, cutaneous, and gastrointestinal problems, a survey of 200 locals who live close to sewage discharge locations will be carried out. To find links between sewage pollution and health consequences, data will be statistically examined.

This integrated approach offers a thorough comprehension of the sewage issue in Bhilwara and its consequences for public health.

## **SEWAGE COMPOSITION ANALYSIS**

Numerous physicochemical and biological pollutants that provide serious risks to the environment and human health are present in Bhilwara's sewage composition. Sewage samples taken from residential and commercial sectors were examined in this study for the presence of pathogens, heavy metals, pH, chemical oxygen demand (COD), and biological oxygen demand (BOD). The findings demonstrate the concerning degrees of pollution in both household sewage and industrial effluents.

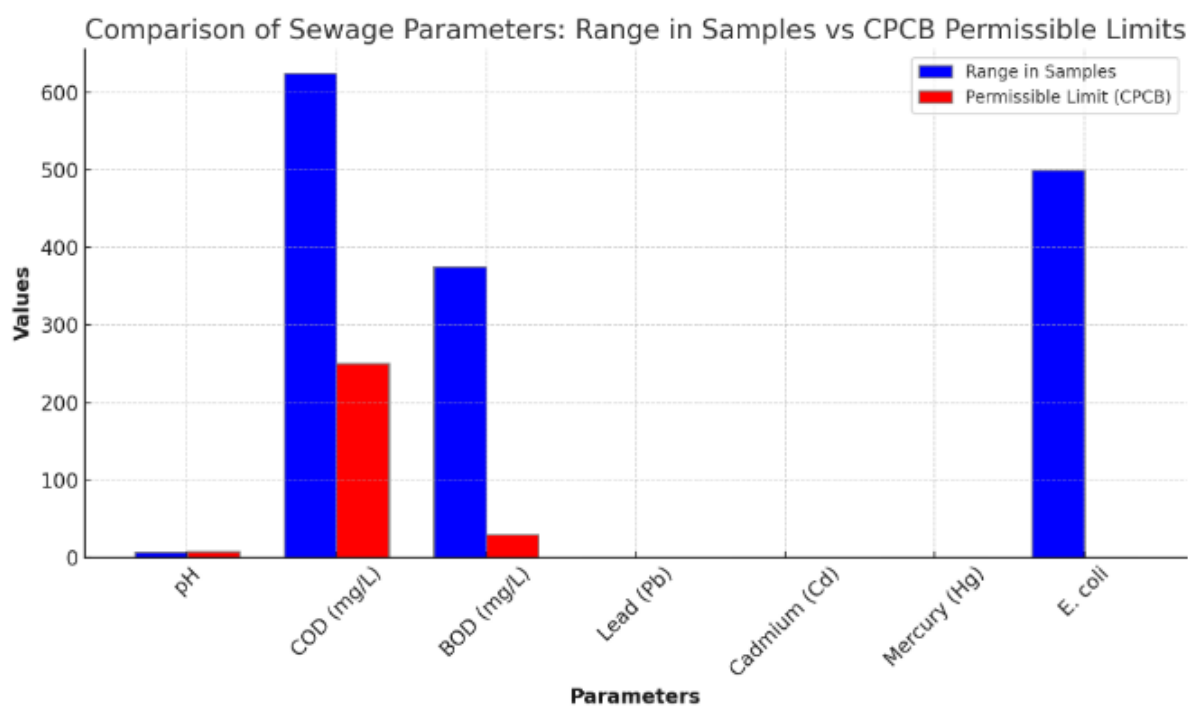
Aquatic life and the chemical behavior of contaminants may be impacted by slightly acidic to neutral environments, as shown by the samples' pH values, which varied from 6.2 to 8.1. With COD levels ranging from 350 mg/L to 900 mg/L and BOD levels from 200 mg/L to 550 mg/L, the levels were both well over allowable limits. These high numbers suggest that there is a significant amount of organic matter present, which lowers oxygen levels in water bodies and kills aquatic life. Lead (Pb), cadmium (Cd), and mercury (Hg) concentrations were alarmingly high, much over permissible limits, according to heavy metal analysis. The range of lead, cadmium, and mercury concentrations was 0.15 mg/L to 0.45 mg/L, 0.02 mg/L to 0.08 mg/L, and 0.005 mg/L to 0.02 mg/L, respectively. When people and animals are exposed to tainted water, these metals may cause neurotoxicity, renal damage, and developmental abnormalities, among other major health problems.

With *E. coli* levels in several samples over 500 CFU/mL, the pathogen load in the sewage

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samples was especially concerning and might result in gastrointestinal illnesses. Chemical pollution and a significant pathogen prevalence indicate that local people may experience both immediate and long-term health effects.

The table that follows summarizes the numerical values of the main pollutants found in the sewage samples:



Here is a comparison chart showing the sewage parameters, with the range of values found in the samples (in blue) and the CPCB permissible limits (in red) for each parameter. The graph provides a clear visual representation of how the sample values for each parameter compare to the regulatory limits.

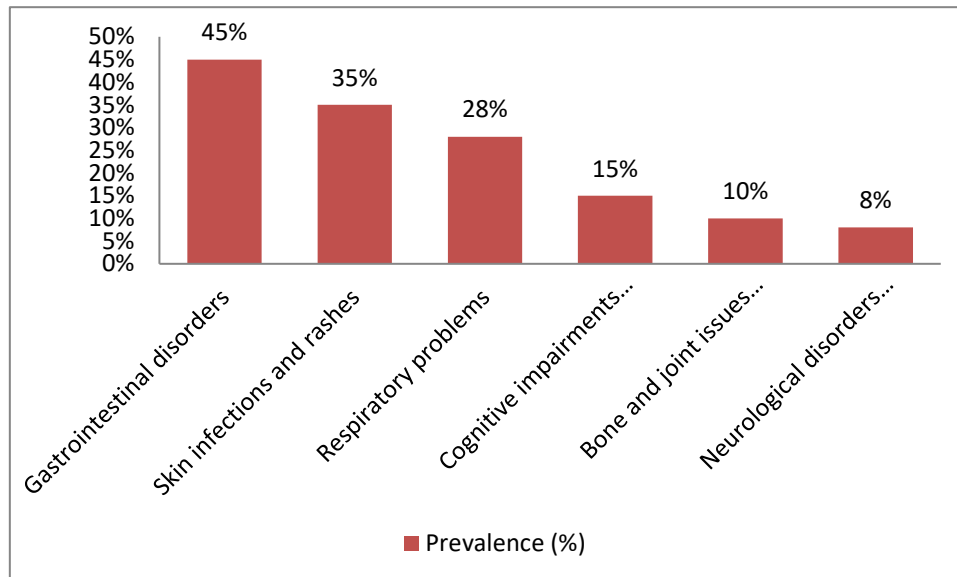
### **IMPACT ON HUMAN HEALTH**

The local population's health is significantly impacted by Bhilwara's untreated or insufficiently treated sewage outflow. Residents are at significant risk for health problems due to the high concentrations of contaminants in the sewage, which include harmful heavy metals and bacteria. Numerous acute and chronic ailments are brought on by prolonged exposure to polluted water, whether by inhalation, skin contact, or eating.

Particularly dangerous are heavy metals such as lead (Pb), cadmium (Cd), and mercury (Hg). Exposure to lead may result in renal damage, hypertension, and cognitive deficits, particularly in youngsters. Mercury exposure may result in neurological and developmental difficulties, whereas cadmium exposure is associated with cancer, respiratory issues, and bone fractures. These problems were more common among those who lived close to sewage discharge locations. Furthermore, widespread gastrointestinal illnesses like cholera, dysentery, and diarrhea have

been brought on by excessive concentrations of germs and pathogens like E. coli. Due to their increased susceptibility to these diseases, children and the elderly have a greater risk of morbidity.

The following health data were obtained from a 200-person local health survey:



These figures demonstrate the significant human health burden resulting from Bhilwara's sewage issues, emphasizing the need for urgent intervention and improved waste management practices to reduce public health risks.

## Discussion

Bhilwara's sewage composition research reveals the serious problems that both household and industrial wastewater present. The sewage is highly contaminated with organic debris, as seen by the high levels of chemical oxygen demand (COD) and biological oxygen demand (BOD). When released into water bodies, this depletes oxygen levels and damages aquatic ecosystems. The issue is made worse by the presence of hazardous heavy metals like lead, cadmium, and mercury, which bioaccumulate and remain in the environment for a long time, endangering the health of both people and animals.

The high levels of bacteria and heavy metals in the sewage are directly linked to the health effects seen in the local population, which range from neurological and cognitive impairments to gastrointestinal illnesses. The issue is made worse by Bhilwara's inadequate sewage treatment infrastructure, which allows untreated or inadequately treated sewage to continue flowing into water sources.

This research emphasizes how urgently sewage treatment plant upgrades, more stringent

industrial wastewater management procedures, and routine water quality monitoring are needed. In order to reduce the health hazards connected to tainted sewage and provide a safer environment for Bhilwara's population, public health awareness programs and healthcare treatments should also be given top priority.

### **Conclusion**

Significant environmental and public health issues are brought on by untreated and inadequately treated wastewater, according to an investigation of Bhilwara's sewage composition. It is concerning that there are large concentrations of organic matter, as shown by higher COD and BOD values, and heavy metals including lead, cadmium, and mercury. Residents who live close to sewage discharge sites, where respiratory issues, chronic ailments, and gastrointestinal infections are common, are especially at considerable risk from these toxins.

The issue is made worse by Bhilwara's textile industry's industrial load and inadequate sewage treatment equipment. A multifaceted strategy is needed to address these issues, which includes improving sewage treatment plants, requiring industry to follow more stringent wastewater management guidelines, and educating the public about the health hazards associated with polluted water.

Bhilwara can prevent environmental harm and protect the health and welfare of its people by implementing quick measures to enhance sewage management, guaranteeing a sustainable and healthy future for the area.

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