



Research Article

Wastewater Management Technologies and Water Pollution Control Laws in India: A Critical Legal Study

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Abstract

“Pollution is nothing but the resources we are not harvesting. We allow them to disperse because we’ve been ignorant of their value.” – R. Buckminster Fuller

As India becomes increasingly urbanised, industrialised, and populous, the volume of wastewater generated continues to rise. The discharge of untreated wastewater into the environment has emerged as a significant contributor to water contamination. This adversely affects human health, biodiversity, and environmental equilibrium. Despite the availability of numerous technical solutions, a robust legal and regulatory framework remains essential in this instance. As per the United Nations. According to the Wastewater Assessment Programme, just 20% of global wastewater is treated. The CPCB's 2021 study indicates that India's wastewater and sewage treatment capacity exceeds the global average of around 20%. Despite the existence of regulations such as the Water Act of 1974 and the EPA of 1986, over 62% of urban sewage remains untreated. The Pollution Control Boards (CPCB/SPCBs) have inadequately fulfilled their responsibilities, and amendments to the Water Act of 1974 in 2024 have resulted in numerous legal complications in this domain. Despite the endorsement of natural treatment systems (NTSs) and reuse by the 2021 National Framework, significant challenges persist regarding infrastructure, funding, and maintenance. The existing laws and regulations are insufficient due to the severity of the issue. We must implement contemporary wastewater management methods and stringent regulations to mitigate water contamination and address this issue.

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KEYWORDS: ecological balance, the Environment (Protection) Act of 1986, wastewater management, the Water (Prevention and Control of Pollution) Act of 1974, and reuse.

1. INTRODUCTION

Water contamination in India has become a significant issue for both environmental integrity and public health. The volume of wastewater generated continues to increase as urban areas expand, enterprises develop, and populations rise. Treating wastewater not only increases water availability but also renders it safe for reuse by reducing harmful substance concentrations. It is regrettable that much of the recycled wastewater in India is either untreated or inadequately purified. India generates around 72,000 million litres of wastewater daily, although only 28% is treated. Seventy-two percent of wastewater remains untreated and is discharged into rivers, lakes, or groundwater, resulting in the polluting of natural water bodies and significant environmental contamination. This circumstance illustrates that despite the existence of technology solutions; significant issues persist within the legal and administrative frameworks. Wastewater management systems purify sewage and industrial effluents for reuse. This safeguards the environment and aquatic ecosystems from contamination. This technology purifies contaminated water, such as sewage and industrial effluent, employing physical, chemical, and biological processes. This renders it safe for reuse or environmental release. The four primary categories of wastewater treatment are: First, Physical treatment, which involves the removal of solid particulates, second chemical treatment, employs chemicals to eliminate pathogens and contaminants, third, biological treatment utilises microorganisms to decompose organic substances, and forth, advanced treatment incorporates contemporary technologies to enhance water purity beyond its original state. Examples of contemporary technology include sewage treatment plants (STPs), membrane bioreactors (MBRs), hybrid granular sequencing batch reactors (GSTs), built wetlands, electrolytic cells, and dissolved air flotation (DAF) systems. These techniques employ physical, biological, and chemical processes to facilitate water filtration.ⁱ Constructed wetlands are an economical and natural solution, whereas membrane bioreactors (MBRs) and granular sludge technologies (GSTs) are effective in compact environments. The emphasis of the inquiry.

The main object of this research is to thoroughly examine the relationship between wastewater management systems and water pollution control measures in India.

Hypothesis:

A significant portion of India's urban sewage remains untreated, indicating the ineffectiveness of water pollution management legislation. Consequently, these laws require immediate amendment.

2. RESEARCH METHODOLOGY

The principal methodology utilised in this study is the Doctrinal research approach.

Importance of the Research:

This research is significant for multiple reasons:

- It elucidates the relationship between environmental legislation and technology.
- It provides policymakers with valuable guidance.
- It reinforces the objectives of sustained growth.

3. Provisions in the Constitution and Statutes of India

The concept of "strict liability" in **Tort law**, which assigns complete responsibility to an individual for any damage resulting from the release of a dangerous or toxic substance, was initially established in the landmark case of *Rylands v. Fletcher*.ⁱⁱ Justice Blackburn stated, "If an individual places, stores, or retains an item on their property that poses a potential harm to others if released, they must accept the associated risks." Should they fail to manage this properly and the material is released, they will be liable for all resultant damages.

Constitutional Clauses:

The Constitution does not contain any provisions that prohibit water contamination. The DPSPⁱⁱⁱ and the Fundamental Duties^{iv} assert that both the State and its citizens bear the responsibility for environmental protection. Article 48A mandates that the state shall safeguard the environment and natural resources while regulating pollution from industrial and other sources. Article 51A(g) stipulates that every citizen have a moral and legal obligation to safeguard the environment and preserve natural resources. The Judiciary has concurred that, through an expansive interpretation of Article 21, all individuals possess the right to clean water and a pristine environment. The Court broadened Article 21 to encompass the "Right to a Clean Environment" in the case of *Subhash Kumar v. State of Bihar*.^v The Court stated, "the right to life encompasses the right to clean air and water, essential for the complete enjoyment of life."

Article 252 empowers Parliament to legislate on matters enumerated in the State List. The Water Act of 1974 was enabled by Article 252, which conferred authority upon the government to enact it.

Bharatiya Nyaya Sanhita, 2023:

Section 279 of the B.N.S. 2023^{vi} prohibits the intentional pollution or contamination of a public spring or reservoir. The statute stipulates that individuals who engage in this conduct may face a maximum of six months' imprisonment. The objective of this regulation is to safeguard public health and water resources.

The Environment (Protection) Act of 1986:

The E.P Act of 1986 is a legislative framework in India designed to consolidate many objectives pertaining to pollution mitigation and environmental preservation. This Act grants the Central Government significant authority to establish environmental standards, formulate regulations, and ensure compliance.^{vii} The Central Government and the CPCB are capable of... They establish regulations, constraints, and quality benchmarks for STPs and ETPs. Nonetheless, it remains ambiguous which therapy technology is requisite. State authorities and enterprises predominantly oversee adherence to regulations, resulting in variable compliance.

The Water Cess Act of 1977:

Effective July 1, 2017, the Water Cess Act of 1977 ceased to be in force.

The National Green Tribunal Act of 2010:

Section 14 empowers the NGT to adjudicate disputes concerning water contamination and violations of wastewater regulations under environmental law. Section 15 penalises those who violate regulations concerning industrial and municipal wastewater and mandates remediation of the issue.^{viii}

The Water (Prevention and Control of Pollution) Act of 1974:

Article 252 facilitated the enactment of the Water Act of 1974 as a significant piece of legislation. This was the inaugural significant legislation aimed at preventing and regulating water contamination. It was enacted to prevent and regulate water pollution, enhance water quality, establish Water Boards for these purposes, and empower these Boards to fulfil their responsibilities.^{ix} The Act was amended in 2024 to decriminalise many offences. The Act prohibits the intentional discharge of contaminants into any water body, sewer system, or land.^x It further states that one must not dispose of any items that could obstruct the natural flow of a river, as this would exacerbate pollution.

As per Section 2(gg) of the Act, a "outlet" is defined as "any conduit, pipe, or channel, whether open or closed, through which sewage or trade effluent flows, or any other storage arrangement that results in, or has the potential to result in, pollution."

Section 2(e) delineates "pollution" as any alteration to the physical, chemical, or biological characteristics of water, including the direct or indirect discharge of sewage, trade effluent, or other substances into water that may jeopardise public health, safety, legitimate domestic, commercial, industrial, or agricultural activities, or the health and vitality of flora, fauna, or aquatic organisms.

The term "stream" refers explicitly to rivers, watercourses (both flowing and dry), inland waterways (both natural and artificial), subterranean waters, and marine or tidal streams that meet certain characteristics.^{xi}

4. Deficiencies in Water Legislation Pertaining to Wastewater Management

1. Section 24 stipulates that untreated wastewater must not be discharged; yet, it lacks a technical explanation for implementation. The Act establishes objectives while allowing the sector to determine the methods for achieving them, resulting in diverse treatment strategies across various locations.
2. Sections 25 and 26 of the Act stipulate that "Consent" (permission) is required; nonetheless, ambiguity persists over the technical specifics. The legislation does not mandate that every industry establish a Sewage Treatment Plant (STP) or an Effluent Treatment Plant (ETP). In the absence of explicit technical requirements, numerous states and enterprises exhibit disparate levels of efficacy in wastewater treatment, resulting in inconsistent pollution

management outcomes. For example, fundamental treatment may suffice in one state, but advanced or tertiary care may be requisite in another.

3. Section 17 stipulates that the primary responsibility of the SPCB is to establish regulations for the disposal of industrial and municipal wastewater and to ensure compliance with these regulations. Nevertheless, SPCB may lack the requisite technical expertise and access to sophisticated monitoring instruments.
4. The Act solely empowers the CPCB to formulate recommendations and establish standards.^{xiii} It lacks the authority to establish these regulations for all states. This results in a deficiency of standardisation and inconsistent application of wastewater treatment technology nationwide. This indicates that the amounts and requirements for therapy differ throughout each state.
5. Section 33A empowers the SPCB to instruct any enterprise that violates pollution control regulations to cease operations. This indicates that the Act employs punishment rather than prevention. The Act neither mandates nor incentivises enterprises to implement technical enhancements.
6. The State and Central Boards possess the authority to inspect enterprises and municipalities and collect samples of their trash. The Act lacks any regulations or guidelines for the utilisation of online sensors or digital tracking systems. Consequently, enterprises and municipal authorities can readily modify data. The Act's regulations concerning wastewater frequently prove ineffective as a result.
7. The Act does not reference any contemporary causes of pollution. The Act primarily targets corporations, despite significant pollution originating from household garbage. The legislation lacks robust and explicit mechanisms to address this issue.
8. The Act stipulates that violations of the law should incur penalties; nevertheless, in most instances, the fines are so minimal that they fail to deter firms from noncompliance. This indicates that numerous enterprises prefer to incur fines rather than invest in adequate wastewater treatment, hence complicating the management of water contamination.
9. Water is a commodity regulated by the government. Each state possesses its distinct method of implementing laws and regulations. Certain governments enforce stringent surveillance, whereas others adopt a more lenient approach. This indicates that the regulations are not being uniformly adhered to across the nation.
10. This legislation typically pertains to rivers, lakes, and other surface water bodies. It lacks definitive strategies to mitigate groundwater contamination and to prevent indiscriminate usage.
11. The Act permits public participation in various capacities. Individuals cannot initiate lawsuits against criminals immediately; they must obtain authorisation from the Board or navigate through its processes.

12. Prosecuting individuals who violate environmental regulations is challenging and complex. This contravenes the primary objective of the "Polluter Pays Principle."
13. India currently lacks a coherent and consolidated governmental policy for wastewater management, resulting in administrative uncertainty.
14. The Act solely penalises individuals who intentionally violate the law. No penalties exist for actions resulting from negligence.
15. The Board is responsible for determining the requisite evidence prior to imposing penalties on pollutants. The Board's insufficient efforts to satisfy the "burden of proof" have resulted in pollutants receiving the benefit of the doubt in numerous instances.
16. The directives from the Central Board and various State Governments to the State Boards are not always coherent and can prove ineffective.
17. Pollution Control Boards are intended to function as independent entities; however, due to excess dependence on the government and other practical constraints, they are often unable to achieve this objective.
18. The Chairperson of the SPCB holds a significant position. This worker must possess the requisite abilities and be capable of full-time employment. The Act, conversely, does not specify any particular qualifications or prerequisites for a full-time appointment.^{xiii}

5. Principal Challenges in Wastewater Management and Mitigating Water Pollution:

1. Accelerated Population Growth: India's population is expanding rapidly, particularly in urban areas, resulting in an incessant increase in sewage and wastewater production. STPs are inadequate for the demands of the expanding population.
2. Urbanisation: Cities and municipal corporations are expanding rapidly, yet they lack the infrastructure to accommodate the influx of additional residents. Urban techniques for collecting and processing wastewater may have become obsolete. In newly constructed cities, the infrastructure for STP and ETP frequently fails to comply with planning criteria. The increasing population and swift urbanisation exert additional pressure on wastewater treatment facilities, complicating pollution management.
3. Industrial waste: Numerous enterprises discharge substantial quantities of hazardous chemicals and refuse into the environment. Numerous small and medium-sized enterprises do not invest in Effluent Treatment Plants (ETPs) or Sewage Treatment Plants (STPs).
4. Insufficient Awareness: Numerous individuals and certain organisations exhibit apathy towards environmental concerns. Individuals and enterprises frequently underestimate the significance of treating wastewater.
5. Corruption and insufficient oversight hinder Pollution Control Boards in fulfilling their responsibilities due to inadequate personnel and technical resources. Not all locations employ online sensors, digital tracking systems, and real-time monitoring technologies.

6. Recommendations

1. The 1974 Act defines "pollution" primarily as chemical, physical, and biological contaminants. Recently, radiation has emerged as a significant contributor to water pollution. Radioactive elements from medical waste can significantly affect water sources. The definition of "pollution" should be amended to explicitly indicate that radiation can contribute to water pollution.
2. The 1974 Act requires modification to align with contemporary norms, and its regulations should mandate the establishment of STPs and ETPs.
3. The term "stream" ought to be modified to incorporate "rainwater."
4. Section 4(2)(a) must be amended to clarify the stipulations of the Water Act regarding the appointment of the Chairperson.
5. Amendments to Section 24 should actualise the concept of "Absolute Liability."
6. Effective management of wastewater in India necessitates a concentration on municipal wastewater. Establishing sewage treatment plants (STPs) is essential for enhancing urban sewage management.
7. Mandatory public hearings should be conducted.
8. The Act mandates specific provisions to facilitate public engagement.
9. India must implement a comprehensive National Wastewater Policy. A Comprehensive National Wastewater Policy would ensure uniform adherence to regulations across all jurisdictions.
10. The Act must provide regulations for establishing objectives and benchmarks for reducing pollution.
11. Qualified individuals should be appointed to lead the teams responsible for this task.
12. A real-time monitoring system utilising the Internet of Things (IoT) should be implemented to swiftly identify pollution occurrences. This system would reduce the likelihood of data alteration and enable authorised individuals to promptly assess conditions and implement swift corrective measures.
13. Advancements in technology are essential for enhancing wastewater management. Industries ought to be incentivised to adopt contemporary techniques such as Zero Liquid Discharge (ZLD), Membrane Bioreactors (MBR), and Reverse Osmosis (RO). The government may offer additional financial assistance to encourage firms to invest in specific technologies.
14. The Public-Private Partnership (PPP) model should be employed for efficient wastewater management.
15. To enhance the efficacy of wastewater management, measures must be implemented to elevate public knowledge. These initiatives should aim to educate both the general populace and enterprises regarding wastewater, encompassing its environmental impact and appropriate disposal methods. Educational institutions, community organisations, and other media outlets can all contribute to increasing awareness. Sixteen. We must devise low-tech, cost-effective, and user-friendly methods to safeguard the

lives of individuals reliant on our waste while concurrently conserving our vital natural resources from depletion.

7. CONCLUSIVE ASSESSMENT

India has achieved significant advancements in technology and legislation pertaining to water pollution and wastewater treatment. Nevertheless, there are further issues that must be resolved prior to the complete enforcement of these regulations. Recent technological advancements have enabled the treatment of a greater number of individuals; nevertheless, these systems remain inadequately utilised, maintained, and equitably distributed. The Water Act of 1974, the E.P. Act of 1986, the CPCB, and other entities collaborate to ensure the regulation of water pollution. It is evident that these regulations are neither being adhered to, monitored diligently, nor enforced rigorously enough. Numerous enterprises and municipal authorities continue to inadequately adhere to regulations, resulting in the contamination of rivers and other water sources. A thorough legal examination reveals that enacting legislation is inadequate; efficient implementation, transparency, public knowledge, and inter-institutional cooperation are essential as well. In the future, it will be essential to advocate for innovative technology, establish decentralised treatment systems, and rigorously implement the "Polluter Pays Principle" through stringent regulations. To achieve its SDGs, India must ensure that technology aligns effectively with legislation safeguarding water resources and advancing environmental justice.

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- ^{xii} S 16.
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