A Study on Effect of Pollution on Land And River Due To Discharge of Paper Packing Factory In Erode District By Using GIS

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Abstract- *Erode city, which serves as the headquarters of Erode District, is beautifully situated along the banks of the Cauvery River in Tamil Nadu. Geographically, it sits between the latitudes of 11° 17' N and 11° 23' N, and the longitudes of 77° 40' E and 77° 46' E, covering an approximate aerial extent of 120 km. The city relies heavily on the Cauvery River for its drinking water supply. Besides this river, the local population also taps into groundwater resources to meet their domestic, agricultural, and industrial needs. However, rapid urbanization and poor waste disposal practices have led to the contamination of both groundwater and surface water in the area. Currently, the city's municipal solid waste is dumped in open landfills at three main sites: Vendipalayam, Vairapalayam, and Semur. The leachate from these open dumps is directly polluting the groundwater and surface water, making it unsuitable for drinking in many areas. To tackle this issue, a comprehensive study was conducted using Geographical Information System (GIS) technology to analyze the spatial variation in the quality of surface and groundwater. In February 2009, researchers collected forty-three groundwater samples and seven surface water samples from the region, analyzing them for various physical and chemical parameters, including pH, Electrical Conductivity, Total Dissolved Solids, Alkalinity, Hardness, and several ions like Na+, K+, Ca2+, Mg2+, Cl, HCO3, CO32, SO4, NO3, and F. The concentrations of these constituents were then compared against the standards set by the Bureau of Indian Standards (BIS) and the World Health Organization (WHO) to assess the water's suitability for drinking. The findings revealed that many locations had water quality parameters exceeding permissible limits, rendering the water unsafe for consumption. Additionally, the spatial variation of groundwater quality parameters was mapped using GIS.*

Keywords- GIS, Unbleached pulp manufacturing, COD, BOD, TDS, Data Collection, Treatment Methods, Waste use and Waste water treatment,

I. INTRODUCTION

Industrialization plays a crucial role in boosting a country's economy by setting up plants and factories. However, the waste and by-products that come from these operations can be incredibly harmful to the environment, as they contain various contaminants that pollute our surface water, groundwater, and soil. There are several reasons why this waste isn't treated safely. A major factor is the lack of efficient and cost-effective treatment technologies. This chapter aims to provide a detailed look at how industrial discharges impact both the environment and human health. Additionally, we will discuss some corrective measures later on to tackle the issue of industrial contamination.

Water (H2O) is created when two hydrogen molecules combine with one oxygen molecule. Interestingly, Earth is the only planet known to have any trace of water. While theories about the origin of water continue to evolve, its importance for all known life forms on Earth is undeniable. Unfortunately, it's estimated that around 90% of the country's water resources are contaminated due to untreated industrial waste, domestic water, pesticides, and fertilizers. As a result, Erode faces a significant challenge in fulfilling its legal and ethical responsibilities to provide safe drinking water. Wastewater, in simple terms, is the used water that flows from a community. Its characteristics—physical, chemical, and biological—vary based on how water is used in the community, as well as contributions from industrial and commercial activities, weather conditions, and infiltration or inflow.

II. RESEARCH OBJECTIVE

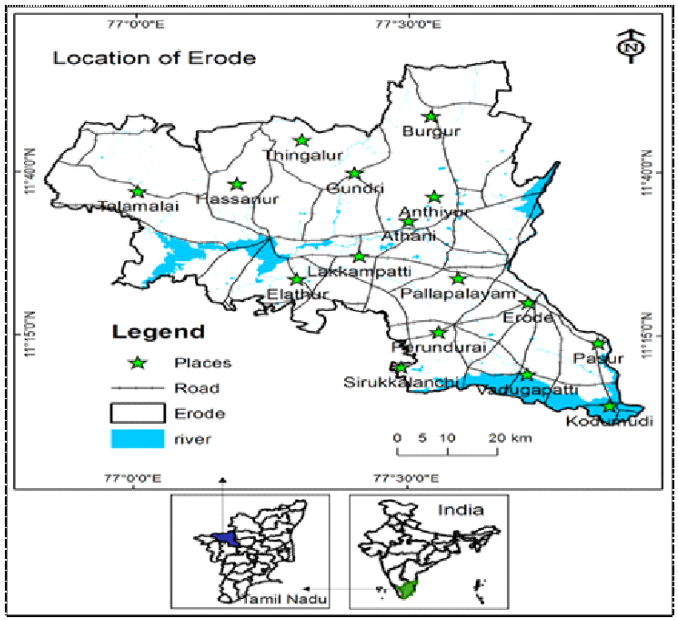
- We aim to identify the sources of potentially harmful elements and organic pollutants found in wastewater from homes, businesses, and urban runoff that ultimately make their way into the wastewater collection system.

- Our goal is to assess the levels of inorganic and organic pollutants present in sewage sludge, as well as the proportion of these pollutants that are released into the environment through treated effluents.
- We will take a closer look at the processes involved in treating wastewater and sewage sludge, along with potential strategies to prevent pollution right at the source. Key practices for treating wastewater and sewage sludge in Europe will be thoroughly examined.
- By conducting a comprehensive review of existing data from various sources, we aim to pinpoint areas that require further research due to a lack of information.
- Polluted runoff stems from a range of land use activities, such as development, transportation, agriculture, and forestry, and can originate from anywhere within the watershed.

III. METHODOLOGY

3.1.STUDY AREA:

Erode District is located in the far north of Tamil Nadu, bordered mainly by Karnataka State, with the River Palar winding through a significant stretch of the area. To the east, you'll find Namakkal and Karur Districts, while Dindigul District lies just to the south. On the western side, Erode shares its borders with Coimbatore and Nilgiri Districts. Essentially, Erode District is a landlocked region, meaning it doesn't have any coastline. It sits between latitudes 10°36' and 11°58' N, and longitudes 76°49' and 77°58' E.



Location of study area

3.2. PAPER PACKAGING INDUSTRY:

The manufacture of paper consists of two main operations: the production of pulp, which is then transformed into paper or cardboard. Industrials can integrate both manufacturing processes.

1. Unbleached Pulp Manufacturing Processes
2. Bleaching
   - Bleaching Pulp Using Ozone
   - Ozone Is Used
3. Wastewater
4. Paper and Cardboard Manufacture
5. Effluent Disposal and Its Environmental Consequences
6. Effect on water quality
7. Effect on land quality
8. Effect on Crops and Livestock

IV. WATER IN THE PAPER MANUFACTURING PROCESS

4.1. TRENDSETTING BY PAPER MILLS:

International Paper Company, based in the U.S.A., has made some significant strides in enhancing the performance of the wastewater treatment plant at its Lock Haven mill. They've managed to boost the loading on their aerated stabilization basin while keeping the effluent discharge limits unchanged. To achieve this, they upgraded the existing static tube mixers in the basin and swapped them out for a new fine bubble diffused air aeration system.

Figure: Joutseno paper mill, Finland

Storaenso of Finland has introduced new techniques taking into account the overall water management system in a paper mill. These include dry debarking of wood, recycling of process water, effective spill monitoring, containment and recovery system, and biological treatment of wastewater. The white water coming out of the paper machinery in the Shan Ying Pulp and Paper Mill in China is led to a common flotation unit and a good proportion of the clarified water is recycled. Moreover, the plant has set stringent targets of reducing water consumption by 33 percent and reducing COD in wastewater by 60 percent.

4.2.WASTEWATER TREATMENT METHODS:

Pulp and paper mills typically handle their combined wastewater through a series of treatment steps. First, they equalize the flow, then move on to primary settling and clariflocculation. After that, they usually employ secondary biological treatment, which can be anaerobic or aerobic. This is followed by the activated sludge process and another round of clarification. Most large mills, along with some medium and small ones, have chemical recovery plants to reclaim spent pulping chemicals. Once treated, the effluent is either disposed of on land, released into surface water like rivers, or sent down drains. The primary sludge is dried in either sludge drying beds or lagoons, depending on how much land is available, and it's often sold to board manufacturers. Wastewater treatments can be broadly divided into physicochemical and biological methods.

4.2.1 PHYSICOCHEMICAL TREATMENT METHODS:

- In the past, a variety of physicochemical methods for color removal have been developed and documented, including adsorption, rapid sand filtration, chemical precipitation, membrane processes, and electrochemical techniques.
- Membrane techniques, while effective, require pre-treatment and come with a hefty capital investment. Additionally, membrane fouling poses a significant challenge with this approach. Both adsorption and membrane processes are efficient, but they can be quite costly.
- Chemical precipitation methods, utilizing substances like alum, ferric chloride, and lime, have been thoroughly researched. Although these methods are economical, they generate a substantial amount of sludge and may not completely eliminate toxicity.

4.2.2 BIOLOGICAL TREATMENT METHODS:

Biological methods hold great promise for tackling the challenges posed by traditional physicochemical approaches. A number of studies have explored how these biological techniques can effectively decolorize and treat wastewater. The color in paper mill effluent primarily comes from lignin, its derivatives, and polymerized tannins, which are tough to break down because of their carbon-to-carbon biphenyl linkages. Interestingly, some microorganisms can biodegrade lignin and its derivatives when the right environmental conditions are met. Various bacteria, including Pseudomonas spp., Flavobacteria, Xanthomonas spp., Bacillus spp., Aeromonas spp., and Cellulomonas spp., have been identified as capable of decomposing lignins. While many bacteria can break down simple lignin structures, only a select few strains can effectively attach to and degrade lignin derivatives produced through different pulping processes.

V. APPLICATION OF GIS SOFTWARE:

A geographic information system (GIS) is a computer-based tool for mapping and analyzing geographic phenomenon that exist, and events that occur, on Earth. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps.

5.1 DATA COLLECTION:

To figure out where accidents are most likely to happen and where traffic tends to get jammed, we gather data from various departments. This data falls into two categories: spatial and non-spatial data.

5.1.1 SPATIAL DATA:

Spatial data gives us precise geometric details like location, boundary extent, and the road network. We sourced the Open Series Map (OSM) from the Survey of India, while the updated taluk map came from the Survey and Settlement Department, and the road network map was provided by the Highways Department.

5.2.2 NON-SPATIAL DATA:

Non-spatial data refers to the information related to spatial data. This includes accident details such as the date and time of the accident, the type of accidents, the vehicles involved, the gender of those involved, whether they were licensed or not, and if alcohol was a factor. We collected these details from the police commission rate in Coimbatore. Additionally, information about bus stops, including routes and numbers, was obtained from the Coimbatore Transport Corporation, and hospital information was gathered from the Coimbatore Health Department.

VI. RESULTS OF PARAMTER FROM RIVER WATER SAMPLES

6.1 Ph:

The concentration of hydrogen ions is a key factor in assessing the quality of effluent discharge from the plant, as it serves as a measure of acidity and alkalinity in an aqueous solution. The pH level of the influent (raw effluent) was

recorded at 8.6 to 9.15, indicating it is alkaline. In contrast, the treated effluent had a pH range of 7.5 to 7.8.

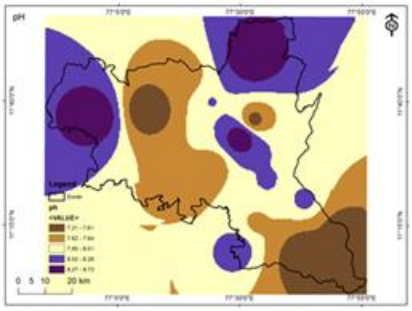


Figure: pH value in study area

6.2 SUSPENDED SOLIDS:

The concentration of suspended solids at the inlet of the Effluent Treatment Plant (ETP) varies between 1470 and 1976 mg/l. After treatment, the concentration of suspended solids in the effluent drops to between 50 and 65 mg/l.

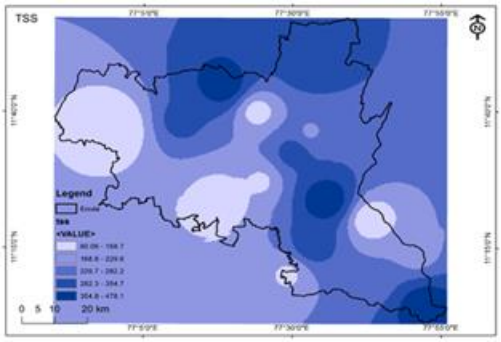


Figure: TSS value in study area

6.3 TOTAL DISSOLVED SOLIDS:

The concentration of total dissolved solids ranged from 2565 to 2715 mg/l at the inlet, while the treated effluent showed values between 1840 and 1960 mg/l. These figures indicate that the TDS levels are within the permissible limits set by the Pollution Board standards.

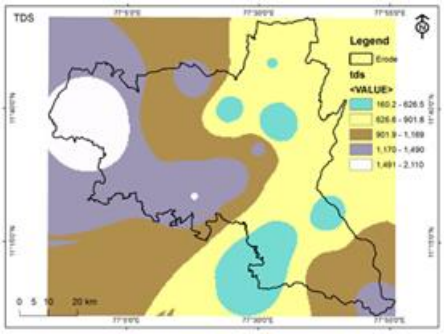
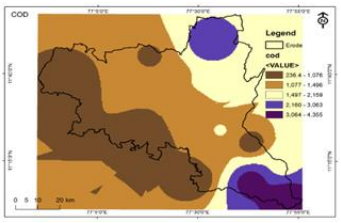


Figure: TDS value in study area

6.4 COD and BOD:

ChemicalOxygen Demand (COD) measures how much oxygen is needed to break down both organic and inorganic materials, while Biological Oxygen Demand (BOD) indicates the oxygen required by microorganisms to decompose organic matter. BOD helps us understand the organic load in streams and gives us a sense of the dissolved oxygen levels. In terms of influent effluent, the COD and BOD levels ranged from 2125 to 2615 mg/l and 740 to 825 mg/l, respectively. On the other hand, the effluent showed COD and BOD levels between 212 and 215 mg/l and 23 to 25 mg/l, respectively. The biological treatment process, which includes equalization, a primary clarifier, an aeration tank, and a secondary clarifier, helps reduce the COD and BOD levels to a certain extent.



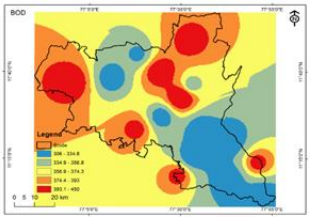


Figure: COD value in study areaFigure: BOD value in study area

6.5 COLOUR:

The colour is often the first thing we notice in wastewater that impacts the look, clarity, and gas solubility of our water bodies.

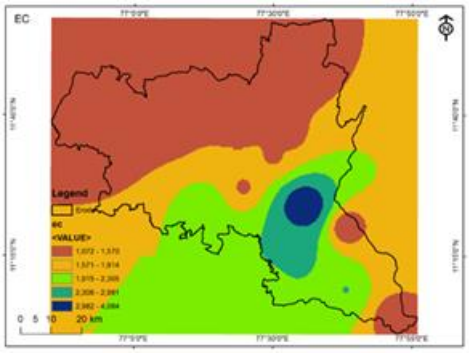


Figure: EC value in study area

VII. CONCLUSION

The paper packaging industry's waste disposal issues along the Erode River call for a well-rounded strategy that combines sustainability, strict regulations, and an active community involvement. Tackling this problem isn't just

about protecting the environment; it's also vital for safeguarding the area's water resources and public health.

- Enhancing Waste Management Systems
- Encouraging Circular Economy Practices
- Involving the Community and Stakeholders
- Driving Policy and Innovation for a Sustainable Future

By bringing together technology, effective policies, and community efforts, we can shield the Erode River from the damaging impacts of industrial paper waste. Adopting a responsible waste management approach will not only protect the river but also foster a greener and more resilient paper packaging industry in the area.

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