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Research Article

Examining Water Pollution Causes in Tiruppur District: Balancing Industrial Growth with Environmental Concerns

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ABSTRACT

The expansion of the industrial sector has been a double-edged sword, fostering economic development while concurrently leading to environmental degradation. Despite the significant contribution of the textile and apparel industry to the nation's gross domestic product and exports, it cannot escape the environmental costs it incurs. Notably, the dyeing process within this industry results in the release of pollutants such as metals, salts, and dyes into wastewater, with a considerable portion of salts ending up in effluents. This discharge of untreated wastewater contributes to water pollution, predominantly through the introduction of organic pollutants like colorants and heavy metal ions. In light of these concerns, a study was undertaken to explore the root causes of water pollution in Tiruppur district. Through this investigation, key factors emerged, including the dumping and mingling of industrial waste in water bodies, the underground pumping of industrial waste via borewells, the mixing of domestic waste into water bodies, the discharge of industrial waste onto farmland, and the introduction of dyeing industrial waste into water bodies with inadequate treatment or left untreated. These identified factors serve as primary contributors to both water and soil pollution in the region, highlighting the pressing need for sustainable industrial practices that balance economic growth with environmental preservation.

Keywords: water pollution, causes, chi square test, Textile industry.

Abstract

In the context of industrial development, environmental degradation has become a pressing issue, despite its contribution to economic growth. Industries, particularly the textile sector, have been significant contributors to this degradation, manifesting in contaminated water, air, land, and noise pollution. The textile industry in India has shown remarkable growth, with exports projected to reach US$ 82 billion by 2021, up from US$ 40 billion in 2014, and apparel demand expected to rise to US$ 122 billion by 2017 (Textile Research Report, 2014). However, this growth comes at a cost, as highlighted by Priya (2018), who emphasized the environmental toll incurred by the textile and apparel industry.

One of the major environmental concerns associated with the textile industry is the discharge of untreated wastewater containing a plethora of pollutants, including dyes, metals, salts, and organic matter. The composition of these pollutants varies depending on the type of dyes used and the dyeing processes employed. For instance, dyeing wastewater often contains organic pollutants such as colorants and heavy metal ions, with chromium concentrations in certain dyes reaching up to 83 parts per million (ppm) (Textile Research Report, 2014; Priya, 2018).

Tiruppur, a prominent textile industrial cluster in India, epitomizes these environmental challenges. The exponential growth of textile units in Tiruppur, from 510 small-scale units before 1990 to over 9000 units post-economic reforms, has significantly intensified pollution levels. Particularly alarming is the discharge of untreated wastewater from dyeing units directly into the Noyyal River, causing detrimental effects on agriculture and the surrounding ecosystem. This scenario underscores the urgent need for a comprehensive study to understand the determinants of water pollution in Tiruppur district.

Therefore, this study aims to investigate the causes of water pollution in Tiruppur district and identify significant contributors to this environmental issue. The specific objectives are:

- To analyze the factors underlying water pollution in Tiruppur district.
- To identify the key determinants of water pollution in the study area.

Keywords: Industrial development, Environmental degradation, Textile industry, Wastewater pollution, Determinants

Review of Literature

Discharging industrial effluents into rivers has led to a significant rise in surface water pollution, with an escalating number of polluted rivers in India. The volume of sewage generated surged from 38,000 million liters per day in 2009 to 62,000 million liters per day in 2015, while the treatment capacity only marginally increased from 18,000 million liters per day to 24,000 million liters per day during the same period, resulting in only one-third of sewage being treated. Consequently, the number of polluted rivers surged from 121 in 2009 to 275 in 2015, with polluted river stretches rising from 150 to 302 during the same period.

The most severely affected rivers include the Yamuna, Ganga, Sabarmati, and Damodar. Despite a decline in agricultural production due to reduced rainfall, studies by Holm (2004), Akilan (2016), and Yuvasakthi and Kumar (2017) have linked water pollution from untreated industrial effluent discharge to agricultural productivity decline. Chandrasekhar (2007) and Yuvasakthi and Kumar (2017) attribute this to a reduction in cultivated land, while Appasamy and Nelliyat (2007) identify water pollution as a primary factor. Empirical evidence by Khai and Yabe (2012) further supports the significant negative impact of water pollution on agricultural production.

Continuous discharge of domestic and industrial waste into nearby water bodies and farmlands has led to overloading pollutants into nature, contaminating water bodies, groundwater, and soil. Environmental issues stemming from industrial effluent disposal on land have been reported across the country, creating localized and regional environmental problems.

Research by Magudeswaran (2007) et al. on the water quality index of the Noyyal River in Tirupur, Tamil Nadu, highlighted the adverse effects of inadequate drainage systems, population growth, and industrial development on water quality in the area. Parameswari and Karunakaran (2010) examined groundwater issues and community awareness near the Perungudi dumpsite in Chennai, revealing poor awareness among lower-income groups about water pollution and groundwater quality. Conversely, Chaudhry et al. (2017) studied factors influencing water pollution in Gujarat from 2016 to 2017, identifying pesticides and industrial wastes as major contributors to surface water pollution.

Methodology

The data for this study was gathered from primary sources, employing a sample of 60 farmers selected through a multistage sampling technique. Initially, villages were categorized into polluted and non-polluted based on their proximity to the Noyyal River in Tiruppur district. Villages within a 3-kilometer radius from the river were considered polluted, while those beyond 3 kilometers were deemed non-polluted. Subsequently, 30 farmers each from polluted and non-polluted villages were randomly selected, resulting in a total sample size of 60.

An interview schedule was devised to collect information on the causes of water pollution, drawing from previous studies such as those conducted by Akilan (2016) and Priya (2018). Identified causes included dumping and mixing of industrial waste in water bodies, pumping of industrial waste into the ground via borewells, mixing of domestic waste in water bodies, pumping of industrial waste onto farmland, and discharge of dyeing industrial waste with partial or no treatment. These causes formed the basis of the interview schedule, and data was collected between July 2020 and December 2020 in the study area.

To measure the severity of each cause of water pollution, a five-point rating scale was utilized, with the following score values assigned:

1.Minimal or no impact on water pollution
2. Low impact on water pollution
3. Moderate impact on water pollution
4. High impact on water pollution
5. Very high impact on water pollution

Farmers' responses were recorded and scored according to this scale to assess the magnitude of each identified cause of water pollution in the study area.
5-Strongly agree, 4- Agree, 3- Neutral, 2- Disagree, 1- Strongly disagree.
To indentify the significant causes of water pollution, chi square test was used. The formula for calculating the chi square was as under;

$$c^2 = \sum_{i=1}^{k} \left[\frac{(O_i - E_i)^2}{E_i} \right]$$

Results of the study:

Causes of Water and Soil Pollution

Earlier studies reported the causes of water pollution such as dumping and mixing of industrial wastes in the water bodies', 'pumping of industrial wastes in the underground through the borewell', 'mixing of domestic wastes in the water bodies', 'pumping the industrial wastes in the farm land', 'mixing the dyeing industrial wastes into the water bodies with partial treatment and untreated', 'increased industrialization', 'increased urbanization', 'increased use of fertilizer and pesticide', 'deforestation and increased agricultural activities' as the causes of water and soil pollution (Akilan 2016 and Priya (2018). The farmers in the study area also reported the above causes of water pollution. Therefore, the above causes of water pollution were included in the present study.
The above mentioned causes of water and soil pollution were measured based on five point rating scale. The scores were assigned as follows;
Strongly agree-5, agree-4, neutral-3, disagree-2, strongly disagree-1
The results of causes of water pollution are given in table- 1

Table- 1 The results of causes of water pollution

Causes	Polluted	Non –polluted
Dumping the industrial wastes in the water bodies	4.27	3.17
Pumping of industrial wastes into the underground through the bore well	3.87	3.07
Mixing of domestic wastes into the Noyyal river	4.23	2.93
Pumping the industrial wastes in the farm land	3.87	2.97
Mixing the dyeing industrial wastes into the water bodies with partial treatment and untreated.	4.67	3.17

Source :Field survey.

The farmers in polluted area strongly agreed the cause 'partial treated water mixed in water bodies' as the major cause of water pollution in Tiruppur district. The farmers also agreed the causes of water pollution such as 'dumping and mixing of industrial wastes in the water bodies', 'pumping of industrial wastes in the underground through bore well', 'mixing of domestic wastes in the water bodies' and 'pumping of industrial wastes in the farm land'. The score values for the above causes were more than 3.5.
The farmers did not agree the above causes of water pollution in non-polluted area. They score value of the above causes was less than 3.5 in non polluted area.
To identify the significant causes of water pollution in the study area, chi square test was used. The estimated chi square values for various causes are given below table-2

Table -2 Association between water pollution and causes of water pollution

Causes	Chi –square value	Sig value
Dumping the industrial wastes in the water bodies	24.594	0.000
Pumping of industrial wastes into the underground through the bore well	14.061	0.003
Mixing of domestic wastes into the Noyyal river	26.400	0.000
Pumping the industrial wastes in the farm land	12.869	0.005
Mixing the dyeing industrial wastes into the water bodies with partial treatment and untreated.	28.370	0.000

Source : Field survey.

The estimated chi square values pertaining to dumping and mixing of industrial wastes in the water bodies', 'pumping of industrial wastes in the underground through bore well', 'mixing of domestic wastes in the water bodies' and 'pumping of industrial wastes in the farm land' and partial treated water mixed in water bodies' were statistically significant at one percent. It could be identified from the probability value which was less than 0.01. It revealed that the dumping and mixing of industrial wastes in the water bodies', 'pumping of industrial wastes in the underground through bore well', 'mixing of domestic wastes in the water bodies' , 'pumping of industrial wastes in the farm land' and partial treated water mixed in water bodies' were the major causes of water pollution in the study area.

Dhanapakiam (2014), Akilan (2016), Dhivya (2016) and Priya (2018) identified the same causes of water pollution in Tiruppur of Tamilnadu.

Conclusion

To sum up, in the polluted area, 'dumping and mixing of industrial waste in the water bodies', 'pumping of industrial waste in the underground through the bore well', 'mixing of domestic waste in the water bodies', 'pumping the industrial waste in the farm land' and 'mixing the dying industrial wastes into the water bodies with partial treatment and untreated' were identified as the primary causes of water and soil pollution.

Recommendation

- The disposal of industrial wastes in the noyyal river at night time was a common practice in Tiruppur. To monitor, the illegal disposal of industrial waste water in noyyal river, the government may appoint a special monitoring board to monitor the illegal disposal of dyeing waste in the water bodies.
- All the industrial units must be encouraged to connect with the common effluent treatment plant. It would reduce the water pollution.
- The dyeing industrial units pumped the waste water in the underground through bore well which must be monitored by the pollution control board regularly. It may reduce the problem of ground water pollution.

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