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Effect of Textile Industry on Quality of Soil and Water and Health of Local People - A Study in Anantapur District

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Abstract: ***Textile industry play an important role in the country economy but plagued by the pollution. It causes air, water and soil pollution and play a major in the health impact of the people working in the industry or the people residing near by areas. This study aims to investigate the effects of the textile industry on the local people's health as well as the environment, particularly the quality of the soil and water, in Anantapur, Andhra Pradesh. The study assessed the impact of pollution by testing samples of soil and water, conducting surveys, and speaking with employees of the industry. The result gives an insight about the quality of water near to the textile industry. Though the pH and the electrical conductivity of the water is equal to the standard value, the high levels of bicarbonate, chloride, and hardness suggest the need for water treatment before use to avoid harmful effects on people and the environment. Similarly, the soil pH was also normal, but the nitrogen and phosphorus values are highly elevated. The study also showed 79% of the people experienced skin related issues and 14% of the people experienced respiratory problems. Proper treatment of water will help in reducing the soil and water pollution.***
Keywords: Textile industry, soil pollution, water pollution, health related issues.

I. INTRODUCTION

India is the 5th largest producer of technical textiles in the whole world with a market size of nearly $22 Bn. The organised textile industry in India is characterised by the use of capital-intensive technology for the mass production of textile products and includes spinning, weaving, processing, and apparel manufacturing (Chandra, 2006). Cotton plays a major role in sustaining the livelihood of an estimated 6 Million cotton farmers and 40-50 Million people engaged in related activity such as cotton processing & trade. This sector accounts for about 2% of the country's GDP and is a substantial foreign exchange earner. India has also earned an enviable global reputation in high-value textiles, encompassing handloom crafts to industrial textile hubs, thus driving traditional and modern manufacturing techniques in the country to meet both domestic and global demand. Though the textile industry have a high impact in the GDP, the other side of textile industry especially in environmental concern it plays a big negative impact due to huge consumption of water and pollution from toxic chemicals and colours. Water bodies get contaminated from the wastewater released at the time of dyeing and finishing, thereby affecting the local towns and the aquatic life. Moreover, high volumes of water utilization impose pressure on resources in areas where water is in shortage. The industry is also one of the major contributors to air pollution due to fumes emitted from production plants, hence contributing to greenhouse gas emissions and causing respiratory health problems (Hopewell, 2024). The untreated wastewater with chemicals, dyes, and heavy metals discharged from India's textile processing industry poses a serious threat to the water quality of the country. These contaminants alter the water habitat and reduce biodiversity apart from changing the pH of the water. The textile processing industry in India contributes negatively toward soil quality due to the disposal of chemical waste and untreated wastewater. Mercury, toxic chemicals, dyes, and heavy metals produced during its processing find a way into the soil, making changes in its natural composition and reducing beneficial microbes that keep the soil healthy. Lowering soil fertility due to this contamination thus affects local agriculture and may even lead to the bioaccumulation of toxins in crops. Apart from water and soil pollution, air pollution in the textile industry especially heating the materials with volatile substances, such as lubricating oils and platicizers, can produce oil mist and organic emissions (Tiwari & Babel, 2013). Textile industry although have the positive impact in the country's GDP, it also has its negative impact in the air, water and soil pollution. The negative impact is the one of the reason for the serious health hazards to the employees and people around them. Respiratory problems, skin disorders, and chronic diseases such as cancer are the possible health issues due to chemicals used in the processes of dyeing, bleaching, and finishing are potential health hazards.

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Based on these impacts, this study aims to investigate the effects of the textile industry on the local people's health as well as the environment, particularly the quality of the soil and water, in Anantapur, Andhra Pradesh. The study also assessed the amount of pollution by testing samples of soil and water, conducting surveys, and speaking with employees of the industry.

II. MATERIALS AND METHODS

A. Study Area

The study was conducted in the city of Anantapur located in the south-central India's Andhra Pradesh state in the southwest. The city is situated in the Rayalaseema uplands region of Karnataka state, approximately 120 miles (190 km) north of Bengaluru (Bangalore) and 80 miles (130 km) south-southwest of Kurnool. Fig 1: Study location

B. Sample Collection

Soil samples will be taken from the areas surrounding the industrial release of wastewater and analysed for contaminants such as boron, copper, and soluble salts. The soil was carefully transported to the lab in the air tight container and stored in the lab at cool place until further use.

C. Primary Data Collection from Workers

The study conducted the questionnaire which comprises of chemical exposure, personal health experiences, and use of protective equipment. Questions included the period of employment, frequency of contact with chemicals, and any observed health changes such as respiratory or skin problems.

D. Primary Data Collection from Residents

Surveys conducted Among the local residents to understand their perception about the environment and health impact of the industry. The questions included the observation on changes noticed in the soil and water qualities, health issues in the household, and concerns about industrial pollution. The questionnaire contains the standardized set of questions which is divided in to two parts
To assess the water and soil quality near the textile industry
To assess the effect of health issues among the workers and the local residents.

III.RESULTS

A. Water Quality Of The Textile Industry

The samples were collected in two different places and marked as A and B. The pH levels of samples A and B were 7.7 and 7.2, respectively. Both the samples were found to be in the safe range (6.5–8.5) with neutral to slightly basic water. Electrical conductivity of samples is very low (0.19 and 0.20 dS/m), meaning very minimal salinity content that can be used generally and agriculturally. However, calcium and magnesium levels (11.6 mEq/L) are much higher than the safe range (0.0007–0.015 mEq/L), which indicates water hardness, making it unsuitable for drinking or industrial purposes. Although carbonate levels are negligible, bicarbonates (7.6 and 8.8 mEq/L) and chlorides (8.8 and 9.6 mEq/L) are above permissible limits, which may pose risks to alkalinity and salinity, affecting crops and soil health. The SAR is low for both samples, within the safe limit. Overall, the high levels of bicarbonate, chloride, and hardness suggest the need for water treatment before use to avoid harmful effects on people and the environment.

Parameter	Optimum range	Sample A	Sample B	Mean	Standard deviation
pH	6.5 - 8.5	7.70	7.20	7.45	0.35
Electrical conductivity(dS/m)	<0.7	0.19	0.20	0.195	0.0071
Ca+ Mg	0.0007-0.015	11.60	11.60	11.60	0.00
CO^3	<0.002	0.00	0.00	0.00	0.00
HCO^3	<1.5	7.60	8.80	8.20	0.85
Residual Sodium Carbonate(mEqI)	<0.0006	0.00	0.00	0.00	0.00
Sodium Absorption ratio (SAR)	<10	0.47	0.48	0.475	0.0071
Sodium (mEq/I)	>0.002	1.14	1.15	1.145	0.0071
Chlorides (mEq/I)	<4	8.80	9.60	9.20	0.566

Table 1: Physical parameter of the water sample

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B. Soil Sample

Soil quality from two textile industries A and B was measured using parameters, such as pH, electrical conductivity, organic carbon, nitrogen, phosphorus, and potassium, whereas Sample B has a pH greater than Sample A and above the normal optimal value for soils. Nitrogen values of both samples are way out of the normal optimal values. Potassium values have a huge variation between samples, which is further underlined by the high standard deviation.

Parameter	**Optimum range**	**Sample A**	**Sample B**	**Mean**	**Standard deviation**
pH	6.5 - 7.5	7.9	9.5	8.7	1.13137
Electrical Conductivity (dS/m)	<0.75	0.15	0.14	0.145	0.007
Organic carbon (%)	0.5 - 2.0	0.42	0.27	0.34	0.106
Nitrogen (Kg/hectare)	0.06 - 0.2	201	239	220	26.87
Phosphorous (Kg/hectare)	0.02 - 1	60.5	57.6	59.05	2.05061
Potassium (Kg/hectare)	4-700	136	25	80.5	78.48

Table 2: Representing the Quality of soil collected from the two different sites near the textile industry

C. Effect of Textile Industry Effluent on the quality of soil, water and health Aspects of Respondents

There may be environmental problems associated with the practices of the Anantapur textile industry since many respondents believe that the sector is damaging the environment. The people feel that the soil quality was deteriorated and becoming unfit for agriculture. Similarly the water quality was also changed with respect to the taste, odour and the presence of sediments. Most of the people will not use the textile industry water for irrigation. Among the health concern, 79% of the people experienced skin related issues and 14% of the people experienced respiratory problems.

S.No	Questionnaire	Responds
1	knowledge about the negative impacts of the textile industry	66.3% know about the negative impact of the industry.
2	Any changes in the soil quality	45.7% of the people observed the changes in the soil sample and the soil texture was different.
3	Changes in the water quality	43.3% observed the changes in the water quality and the changes in the taste of the water was observed.
4	Experience of health issue in the local residents	21.2% observed the health issue in the family members and mostly the skin related disease was observed.

Table 3: List of questions and the responds obtained from the people

IV. DISCUSSION

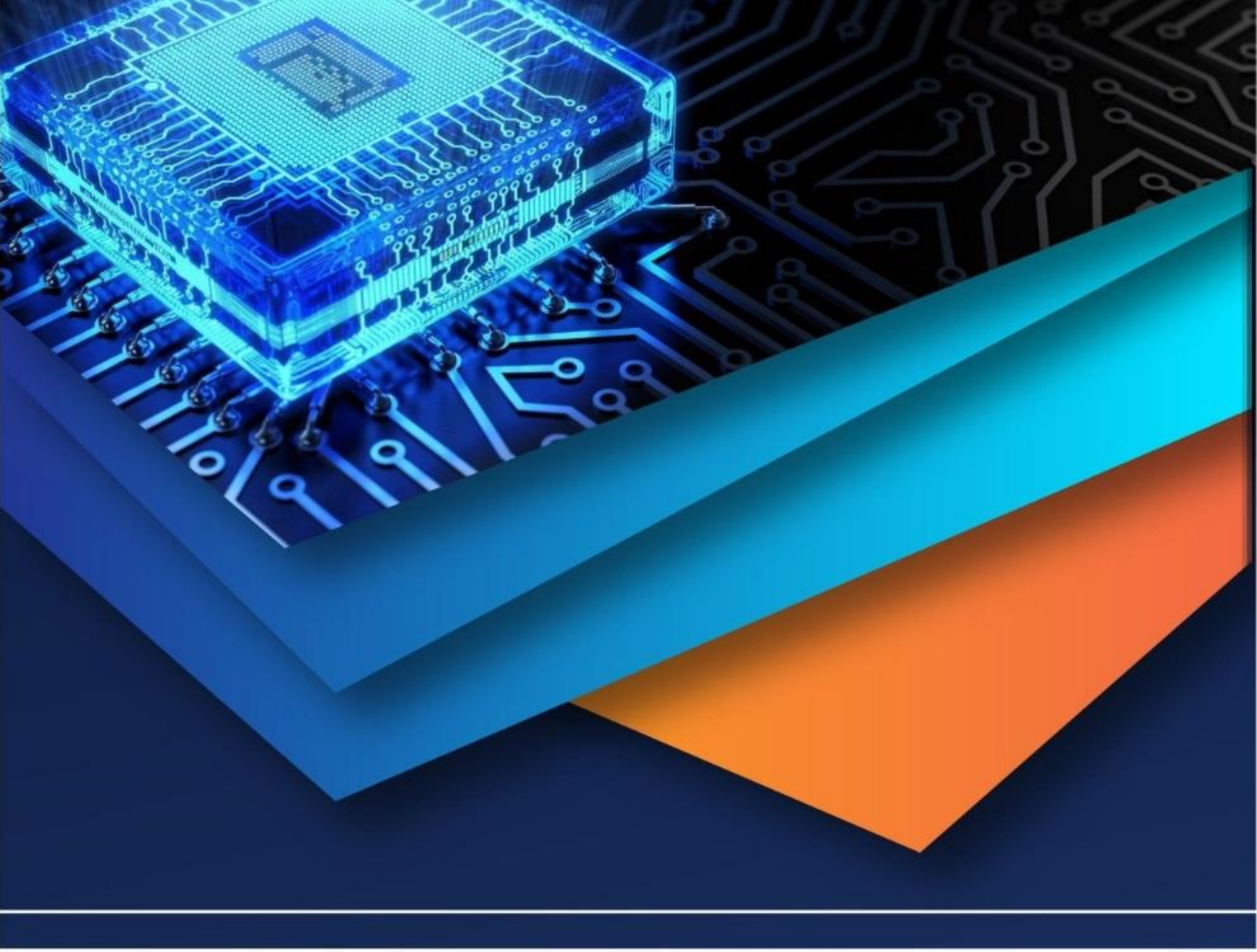
Textile industry is one of the key industries that has contributed significantly to the nation's economy is the textile sector, which is a subset of manufacturing. In India, it accounts for 14% of industrial production, 3% of gross domestic production, 8% of total excise revenue, 17% of export earnings, and—above all—directly employs more than 35 million people (Bhar, 2016). It also has a negative impact on the other side. It is the most polluting industry; their high energy, water, and chemical consumption, as well as the production of textile waste and the release of microfibres into the environment during laundering, all contribute to their negative ecological impact (Niinimäki et al., 2020). In the present study, water quality and soil quality was measured.

The water quality of was not changed near the textile industry. The mean pH of the water samples collected at two different sites was 7.45±0.35 which was similar to the previous study conducted in China (Li et al., 2023). Similarly in the soil sample the mean pH was found to be 8.7 which is almost equal to the standard because the nature of the soil is slightly alkaline and previous study also showed the similar result (Dave & Vyas, 2022). The nitrogen and phosphorus level in the soil was extremely high which affects the quality of water and soil. Previous study conducted in Rajasthan also shows the similar level of potassium in the soil (Dave and Vyas, 2022). The people around the industrial area and workers have the symptoms of respiratory disorder and skin related problems as observed in the previous study (Sudha et al., 2014). For a more economical and environmentally friendly textile industry, a suitable method of wastewater detoxification must be used.

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