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Characterization of Textile Dye Effluents and Evaluation of their Impact on Soil Physicochemical Properties in Industrial Regions of Rajasthan

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Abstract: *One of the important industries that contributes to the generation of industrial wastewater with synthetic dyes, salts, surfactant, heavy metals and organic/inorganic contaminants. Untreated or partially treated effluents are continuously released from the textile industries and pose great risk for the environment particularly in industrialized areas and impact on soil quality. The present work is aimed to characterize the textile dye effluents and to study its impact on the physicochemical properties of the soils of selected textile industrial areas of Rajasthan, India. The following water quality characteristics were measured for effluent samples: pH, electrical conductivity (EC), total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), chlorides, sulfates and various concentrations of heavy metals; and soil samples were analyzed for pH, electrical conductivity (EC), organic carbon, moisture content, CEC, available N, P, K and various concentrations of heavy metals. Comparative analysis of contaminated and uncontaminated sites was used to assess degradation of soils. It is observed that textile effluents have a significant influence on salinity, alkalinity, soil accumulation of heavy metals and decrease in soil fertility and nutrient availability in the soil during long term exposure. These modifications are the negative effects on soil health, crop and farm productivity and ecological resilience. The study highlights the need for the development of efficient effluent treatment plant and periodic environmental monitoring and enforcement of the pollution standard to promote sustainable management of soil resources in the textile belt of Rajasthan for minimizing pollution from industries.*

Keywords: Textile dye effluent, Rajasthan, Soil physicochemical properties, Industrial wastewater, Heavy metals, Environmental pollution, Textile industry, Soil quality, Wastewater characterization, Sustainable management.

I. INTRODUCTION

The textile industry is one of the foremost sectors in the economic development of India in terms of job creation, export earnings and industrial development. Rajasthan is also a big state which produces a lot of textile products with its renowned textile clusters in Bagru, Sanganer, Pali, Balotra, Bhilwara, Jodhpur and Jaipur where dyeing, printing, bleaching and finishing of fabrics is done. They are industries which use significant amounts of water and generate high amounts of wastewater that contain dyes, salts, alkalis, acids, surfactants, suspended solids, organic pollutants and heavy metals. As a result, effluents from textile industry are characterized with high pH, electrical conductivity (EC), total dissolved solids (TDS), biological oxygen demand (BOD) and chemical oxygen demand (COD) which makes them one of the most difficult effluents from industries to treat effectively.

Untreated or poorly treated textile effluents discharged into the fields and adjoining water bodies is a critical environmental issue. Persistent dyes, excess salts, toxic metals like chromium, lead, cadmium, copper, nickel and zinc, in soils, change the physicochemical properties of soils, lessen nutrient availability, raise salinity and alkalinity levels, and affect microbial activity. These changes have negative impacts on soil fertility, crop productivity, water quality and

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ecosystem health. Such a degradation is very serious in the Rajasthan where the agriculture is still a main occupation of the people and consequently it is very much a socioeconomic and environmental problem.

The objective of this study is to characterise textile dye effluents in the major industrial area of Rajasthan and their effects on physicochemical properties of soil. The wastewater quality assessment, soil analysis and multivariate statistical techniques used in the study offer scientific evidence for sustainable wastewater management, pollution control measures and environmentally-friendly industrial development.

II. LITERATURE REVIEW

Mathur, et al. (2026) studied the physicochemical properties of textile effluents and the level of pollution of soils in agricultural fields near the textile mills of Sanganer, Rajasthan, in terms of contamination by heavy metals. The study found high levels of chemical oxygen demand (COD), total dissolved solids (TDS), chlorides, sulfates, chromium, cadmium, lead and nickel in the wastewater samples, which are all higher than the recommended environmental limits. In turn, this led to high amounts of heavy metals and other changes to the physicochemical properties of soils receiving textile wastewater. Textile dyeing and printing activities were identified by multivariate statistical analysis as the main sources of pollution. To reduce industrial pollution and protect soil and water resources, the authors have recommended strengthening Common Effluent Treatment Plants (CETPs), and a continuous monitoring of the environment, implementation of cleaner production technologies and strict enforcement of the regulations.[1]

Sathya, Kanimozhi and Panneerselvam (2025) studied the physicochemical parameters of the effluents generated in the textile industry and observed that most of the effluents had the parameters more than the permissible limits for the discharge of pH, electrical conductivity (EC), chemical oxygen demand (COD), biological oxygen demand (BOD) and total dissolved solids (TDS). The research concluded that untreated textile effluent has continuous discharge for a considerable amount of time which causes serious issue of soil salinization, soil accumulation of heavy metals, soil fertility loss and ecological damage. Given the importance of sustainable wastewater management, the authors advocated for the use of wastewater treatment technologies that can enhance effluent quality and minimize environmental pollution, including membrane filtration, adsorption using biochar, microbial biodegradation and biological wastewater remediation.[2]

Aragaw (2024) has reviewed the latest developments in microbial degradation of textile dye effluents and reported that textile effluents consist of a high level of reactive dyes and other auxiliary chemicals, dissolved salts, and surfactants, which are not easily biodegraded using the conventional biological treatment methods. The review pointed out that low fixation efficiency of reactive dyes leads to high chemical oxygen demand (COD), biological oxygen demand (BOD), total dissolved solids (TDS) and electrical conductivity (EC) in wastewater during the dyeing process. The author highlighted the potential of microbial consortia, bacterial strains and ligninolytic fungi in efficient dye degradation and suggested the combination of the biological and advanced oxidation technologies to attain sustainability and environmental friendly treatment of textile effluents.[3]

Dutta (2022) has summarized the various impacts of effluents generated in textile dyeing and found that the discharge of untreated or poorly treated dyeing effluents is a serious threat to the surface water, ground water and agricultural soils. According to the review, textile effluents are often contaminated with synthetic dyes, heavy metals, chlorides, sulfates, surfactants, and persistent organic pollutants which are harmful to aquatic ecosystems, soil fertility, microbial diversity, and crop productivity. The author critically studied the traditional physicochemical, biological and advanced

[1] H. Mathur, et al. (2026). Preliminary monitoring of physicochemical parameters and heavy metal contamination in textile wastewater and soils of Sanganer, Rajasthan. *Discover Environment, 3*(1), 1–16.

[2] S. Sathya, G. Kanimozhi, & A. Panneerselvam. (2025). Physicochemical characteristics of textile industry effluents and their environmental implications. *Journal of Biodiversity and Environmental Sciences, 26*(4), 159–168.

[3] Tesfaye A. Aragaw. (2024). Microbial biodegradation of textile dye wastewater: Recent advances and future prospects. *Environmental Advances, 15*, 100512.

wastewater treatment technologies and concluded that comprehensive treatment systems, cleaner production methods and strict environmental regulations are necessary to reduce the industrial pollution and achieve sustainable production of textiles.[4]

Singh and Sharma (2022) studied the impact of textile effluents on agricultural soil in the vicinity of textile industries in Pali, Rajasthan. Their study found that soils irrigated with the textile wastewater had significantly higher pH, electrical conductivity (EC), total dissolved solids (TDS), chromium, copper, zinc and lead concentrations than did the control soils irrigated with freshwater. The scientists also noticed significant decreases in nitrogen, phosphorus and potash, which showed that soil fertility was being lost over time as a result of wastewater irrigation. They found that untreated textile effluents can cause environmental problems and recommended frequent monitoring of the environment, efficient wastewater treatment and sustainable irrigation to reduce environmental degradation.[5]

III. MATERIALS AND METHODS

3.1 Study Area

The present study has been conducted in the most important textile industrial clusters of the country, all of which are located in the Rajasthan. These clusters are grouped together and form one of the largest textile processing areas of India, namely, Bagru and Sanganer (in the Jaipur District), Pali, Balotra (in the Barmer District) and Bhilwara. These industrial centres are known for significant amounts of textile dyeing, printing, bleaching, washing and finishing activities that result in huge amounts of industrial wastewater on a daily basis. The climate of the study area is semi-arid with an average annual rainfall of about 300 – 700 mm, and temperature ranging from 5°C in winter to 46°C in summer. However, as the availability of freshwater is limited, the irrigation of the adjacent agricultural land is often done by using treated and/or untreated textile effluents which puts the soil under risk of salinization, heavy metal pollution and environmental degradation. To ensure reliable and representative environmental assessment, representative sampling locations were selected based on their close proximity to the industrial wastewater discharge channels, irrigation fields for effluent and nearby uncontaminated control sites using GPS.[6]

3.2 Research Design

The present investigation used descriptive, analytical and comparative research design to assess the physicochemical properties of Textile Dye Waste and its impacts on soil quality for the main textile industrial areas of Rajasthan. The study combined field investigations, systematic sampling, lab experiments and statistical analysis to achieve extensive and accurate environmental data. Wastewater samples were collected as representative samples from selected textile dyeing and printing industries, and soil samples were collected from agricultural fields that received the irrigation of textile wastewater, and nearby fields that received freshwater irrigation were used as control fields. The research consisted of two major parts: (i) Physicochemical and heavy metal analysis of textile dye effluents, and (ii) assessment of the soil physicochemical characteristics, to evaluate the effect of long term wastewater irrigation. The comparison of contaminated and control sites allowed changes in soil quality due to the discharge of textile effluents to be identified. To support an in-depth scientific understanding of soil environment assessment, statistical methods such as descriptive statistics, Pearson's correlation, one-way ANOVA, Principal Component Analysis (PCA), and Hierarchical Cluster Analysis (HCA) were used to analyze the relationships between the characteristics of wastewater, heavy metal accumulation, and soil degradation.[7]

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[4] Pranab Dutta. (2022). Effects of textile dyeing effluent on the environment and its treatment: A review. *Environmental and Sustainability Letters, 5*(1), 34–48.

[5] S. Singh, & V. Sharma. (2022). Impact of textile effluents on agricultural soils surrounding textile industries in Pali, Rajasthan. *The Scientific Temper, 13*(2), 45–54.

[6] American Public Health Association. (2023). *Standard methods for the examination of water and wastewater* (24th ed.). APHA Press.

[7] Bureau of Indian Standards. (2021). *Indian standards for irrigation water quality*. Bureau of Indian Standards.

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3.3 Collection of Textile Dye Effluent Samples

The textile dye effluent sample was collected from the last point of textile effluent discharge, before discharging to drainage channels or Common Effluent Treatment Plants (CETPs), of selected textile dyeing and printing industries. Representative wastewater samples were collected in sterile one-litre high density polyethylene (HDPE) bottles which were well cleaned with detergent, flushed with distilled water, soaked in dilute nitric acid, and then rinsed with distilled water to remove possible contamination. Each bottle was washed twice with the wastewater for sampling before collecting the sample. Samples for heavy metal analysis were immediately acidified with concentrated nitric acid so as to keep the pH below 2 to avoid precipitation and adorption of metals on the walls of containers. All of the collected samples were appropriately labelled, transported to the laboratory in insulated ice boxes and kept at 4°C until they were analysed for physicochemical properties and heavy metals following standard laboratory procedures.[8]

3.4 Soil Sampling

The long-term impact of industrial effluents on soil physicochemical properties were assessed by taking soil samples from the agricultural fields that had been continuously irrigated with textile effluent for over 5 years. The soil samples collected in the control areas were from agriculture fields in the same locality where only groundwater or canal water is used and the soil and crop conditions are same as that of the experimental blocks. Surface litter, stones and plant residues were thoroughly removed before sampling. A clean stainless-steel auger was used to take soil samples to a depth of 0–20 cm. Five sub-samples were taken at each sample site, and composited thoroughly for each sample site to create a representative composite sample. Around 2 kg of composite soil was taken from each sample area and was placed in sterile polyethylene bags, labeled, and taken to the laboratory. The samples were air dried, sifted, and then analyzed for physicochemical properties and heavy metal content by standard analytical techniques.[9]

3.5 Statistical Analysis

To interpret the results correctly, the experimental data were statistically analyzed using software IBM SPSS Statistics (Version 29), R software (Version 4.4 or later) and Microsoft Excel 2021. Descriptive statistics, such as means, standard deviations, minimum, maximum, and coefficient of variations, were calculated for summarizing the characteristics of the physicochemical properties of textile wastewater and soil samples. Pearson's correlation analysis was used to investigate the relationships among the wastewater quality parameters, soil physicochemical parameters and heavy metal concentration and the levels of significance were set at $p<0.05$ and $p<0.01$. The differences among the selected industrial regions were tested by One-way Analysis of Variance (ANOVA), followed by Tukey's Honest Significant Difference (HSD) post hoc test. In addition, Principal Component Analysis (PCA) and Hierarchical Cluster Analysis (HCA) were used for the major pollution source identification, the classification of the sampling sites and the interpretation of the multivariate relationships. The analytical results were finally compared with BIS, CPCB, FAO and WHO standards to evaluate the water quality of the wastewater, soil contamination and the environmental hazards due to the continuous irrigation of the wastes of the textile industry.[10]

Results

Table 3.1 Sampling Distribution Used in the Present Study

Sample Category	Number of Samples
Textile Dye Effluent Samples	50
Wastewater Irrigation Channel Samples	20
Effluent-Irrigated Soil Samples	75

[8] Central Pollution Control Board. (2021). *General standards for discharge of environmental pollutants*. Ministry of Environment, Forest and Climate Change, Government of India.

[9] Food and Agriculture Organization of the United Nations. (2021). *Water quality for agriculture*. FAO.

[10] Food and Agriculture Organization of the United Nations. (2024). *The status of the world's land and water resources for food and agriculture: Systems at breaking point*. FAO.

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Control Soil Samples	25
Total Samples	**170**

Interpretation

The sampling distribution used in the present investigation is given in table 3.1. To get a comprehensive environmental assessment 170 samples were collected from the selected textile industrial regions of Rajasthan. The highest percentage was 75 soil samples from effluent irrigated soils which enabled detailed evaluation of long term effects of textile wastewater on soil physicochemical properties. Furthermore, 50 samples of effluent from textile dyes were collected to characterize the quality of the waste water and 20 wastewater irrigation channel samples were taken to evaluate the pollutant transport pathways. Twenty-five samples of control soil were taken from freshwater-irrigated fields, and the conditions were used as controls for comparison. This balanced sampling increased the reliability, representativeness and statistical validity of the results of the study.

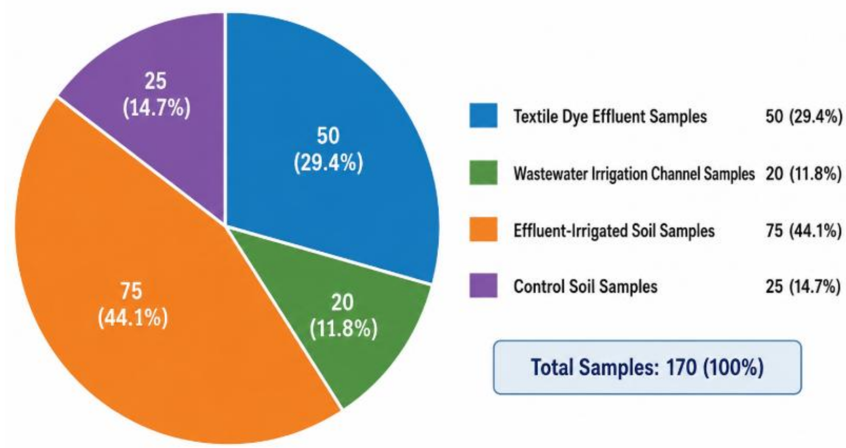

Figure 3.1: Sampling Distribution Used in the Present Study

IV. DISCUSSION

4.1 Physicochemical Characteristics of Textile Dye Effluents

The present investigation showed that the physicochemical parameters of effluents produced from textile industries of the major industrial areas of Rajasthan are very complex which are responsible for causing high level of degradation in environment especially agricultural soils. The wastewater had high levels of dissolved salts, suspended solids, organic pollutants and heavy metals, suggesting that untreated or partially treated textile effluents are a significant contributor of industrial pollution. The high pH, electrical conductivity (EC), total dissolved solids (TDS), biological oxygen demand (BOD) and chemical oxygen demand (COD) values indicate that a lot of dyes, alkalis, salts, surfactants and auxiliary chemicals has been used in the textile processing. These pollutants can have a negative impact on soil quality by raising salinity, alkalinity and decreasing nutrient availability and microbial activity. The result observed is in agreement with the recent studies carried out in Rajasthan and other textile producing areas of the world, which also reported high levels of pollutants dumped and degradation in environmental quality because of continuous dump of inadequate treated textile wastewater. The findings, overall, highlight the critical importance of implementing sound wastewater treatment and sustainable management of industrial waste.[11]

4.2 Influence of Alkalinity and Salinity on Soil Properties

The present study shows that the alkaline nature of textile dye effluents (mean pH 9.24) is mainly due to the use of a large quantity of sodium hydroxide, sodium carbonate and other alkaline chemicals in dyeing, bleaching and finishing

[11] United Nations. (2023). *The Sustainable Development Goals Report 2023*. United Nations.

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processes. Repeated use of such wastewater for irrigation of agricultural land caused a marked increase in soil pH which lowered the availability of micronutrients (Fe, Mn, Cu and Zn) required for healthy plant growth. This was confirmed by elevated electrical conductivity (EC) and total dissolved solids (TDS) which tended to increase soil sodicity and salinization. The overall decline in soil productivity was caused by negative effects of salt build-up on soil aggregation, permeability, water inlet, aeration and root development. Also, prolonged exposure to saline and alkaline wastewater affected the microbial activity and nutrient cycling, accelerating the soil degradation. The results indicate that the uncontrolled irrigation of textile dye effluents can significantly degrade the physicochemical properties of soils, which is a significant issue for sustainable agriculture and environmental quality in areas where textile industries are functioning.[12]

4.3 Organic Pollution and Wastewater Quality

The present study showed that the textile dye effluents had significantly high chemical oxygen demand (COD) and biological oxygen demand (BOD) as compared to the acceptable limits of effluent discharge, which means significant load of organic pollution. The high COD and BOD concentrations could be explained by the presence of synthetic dyes, surfactants, detergents, starch, sizing agents, lubricants and other textile processing auxiliaries which are discharged during the manufacturing process. High COD also indicates the presence of potential persistent aromatic dye compounds that are biological treatment resistant, which can make wastewater treatment more difficult. Such untreated or partially treated effluents can, if discharged continuously into natural water bodies, lead to a substantial drop in dissolved oxygen levels, inhibit microbial breakdown and negatively impact aquatic flora and fauna. Persistent organic pollutants can also degrade water quality and cause ecosystem imbalances, as well. The results underscore the inadequacy of traditional wastewater treatment methods and underscore the importance of implementing advanced wastewater treatment technologies such as advanced oxidation processes, membrane filtration and biological treatment to efficiently treat effluent containing organic pollutants and provide environmentally sustainable management of textile wastewater.[13]

4.4 Heavy Metal Accumulation and Environmental Risks

The heavy metal analysis showed that both textile wastewater and soils irrigated with the effluent contained significant amount of chromium, cadmium, lead, copper, nickel, zinc and iron, suggesting a high level of contamination due to textile processing activities. The most enriched metal was chromium, which is heavily used in textile dyes, pigments and mordants. Continuous irrigation with contaminated wastewater causes the concentration of heavy metals to increase in the surface soils over time, since they are not biodegradable and persistent in soil. This buildup negatively impacts soil microbial diversity, enzyme activity, nutrient cycling, and decaying processes that result in less soil fertility and productivity. High levels of heavy metals also affect seed germination, plant growth, root development, photosynthesis and general plant metabolism, resulting in reduced yield. In addition, these toxic metals can be taken up by plants and then consumed by people, causing various chronic illnesses, kidney disease, neurological disorders and other health effects. Hence, it is extremely important to monitor and effectively treat the textile wastewater continuously to avoid the long-term heavy metal pollution and to ensure sustainable agricultural and environmental management.[14]

4.5 Impact on Soil Physicochemical Properties

The soil physicochemical properties were significantly affected after long-term application of textile effluents as can be seen by comparing the effects of textile wastewater-irrigated soils with the control soils irrigated with freshwater. The

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[12] United Nations Environment Programme. (2023). *Global Environment Outlook: Freshwater quality assessment*. United Nations Environment Programme.

[13] United Nations Educational, Scientific and Cultural Organization. (2024). *United Nations World Water Development Report 2024: Water for prosperity and peace*. UNESCO.

[14] World Health Organization. (2022). *Guidelines for the safe use of wastewater, excreta and greywater in agriculture*. World Health Organization.

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higher electrical conductivity of the soil reflected the salinity build-up with the accumulation of dissolved salts in textile effluents. At the same time, a decrease in the amounts of nitrogen, phosphorus, potassium and cation exchange capacity indicated a decline in soil fertility and nutrient holding capacity. While some enhancement in soil carbon stock was noted from deposition of wastewater derived organic residues, the overall soil quality improvement was prevented by the high salinity and heavy metal load which caused loss of beneficial soil microorganisms and enzymatic activity associated with the soil's ability to cycle nutrients. In addition, the deterioration of soil structure caused water infiltration, aeration and root penetration to be less, which affected plant growth and crop productivity. The results suggest that the long-term use of untreated or poorly treated textile effluents damages soil properties and sustainability of agriculture, thereby highlighting the importance of implementing proper wastewater treatment and regular soil quality monitoring in textile industrial areas.[15]

4.6 Correlation between Wastewater Characteristics and Soil Degradation

Strong positive correlation was found between the wastewater electrical conductivity (EC), total dissolved solids (TDS), chemical oxygen demand (COD), and soil electrical conductivity (EC) and can be attributed to the fact that as the amount of pollutants in the textile effluents increases, the electrical conductivity of the soil increases. The long-term irrigation with textile wastewater resulted in higher concentrations of dissolved salts which correlated well with increased soil salinity. Higher chromium concentrations in the wastewater correlated well with contaminated soils, providing further evidence that industrial effluents were the main source of heavy metal contamination of the soils. These relationships show that poorer wastewater quality negatively impacts on soil physicochemical properties, nutrient availability and soil health. The results of the statistical analysis also indicate that the continuous use of wastewater for irrigation contributes to the increase in salinity and heavy metal levels that leads to lower productivity and environmental sustainability. Overall, the correlation analysis confirms the cumulative and long-term impacts of textile wastewater on soil degradation and highlights the importance of regular monitoring, efficient wastewater treatment, and sustainable irrigation practices to minimize environmental pollution.

V. CONCLUSION

The present study gives a detailed evaluation of physicochemical properties and effect of textile dye effluents on the condition of agricultural soils in the major textile industrial areas of Rajasthan. The results show that a large number of the dissolved salts, suspended solids, organic pollutants, and heavy metals present in the textile effluents are found in high concentration, many of which are found to be above the permissible limit stipulated by the national and international environmental standards. Untreated or partially treated textile effluents have been used for continuous irrigation for significant period of time resulted in the changes in physicochemical properties of soil in the study area which contributed to increase in the soil pH, electrical conductivity, salinity and heavy metal accumulation and decrease in the availability of essential nutrients and the overall soil fertility. The adverse impact of these changes on soil quality is a major concern for sustainable future agricultural production and environmental health.

The use of descriptive statistics revealed that there is a strong relationship between the composition of wastewater and soil degradation; Pearson's correlation analysis, one-way ANOVA, Principal Component Analysis (PCA) and Hierarchical Cluster Analysis (HCA) confirmed that effluents from textile industries are a significant source of soil contamination. The study also found significant differences between the level of pollution in the selected industrial areas, further highlighting the importance of regional approaches to pollution management.

In conclusion, the findings highlight the critical need for effective wastewater management, pollution reduction strategies in industrial processes, compliance with environmental laws, and ongoing monitoring of industrial pollution levels. Use of advanced treatment systems, use of wastewater for recycling, and sustainable irrigation systems will reduce soil contamination, conserve groundwater, and maintain ecosystem integrity. The results of the study have given

[15] M. R. Islam, M. S. Rahman, & M. A. Hossain. (2025). Sustainable remediation technologies for textile wastewater and contaminated soils: A comprehensive review. *Journal of Environmental Management, 372*, 123456.

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valuable scientific inputs to the Government, Environmental agencies and the textile industry in designing effective measures for pollution control and for the development of the textile industry in the environment friendly manner in Rajasthan and other textile producing areas.

REFERENCES

1. American Public Health Association. (2023). *Standard methods for the examination of water and wastewater* (24th ed.). APHA Press.
2. Bureau of Indian Standards. (2021). *Indian standards for irrigation water quality*. Bureau of Indian Standards.
3. Central Pollution Control Board. (2021). *General standards for discharge of environmental pollutants*. Ministry of Environment, Forest and Climate Change, Government of India.
4. Tesfaye A. Aragaw. (2024). Microbial biodegradation of textile dye wastewater: Recent advances and future prospects. *Environmental Advances, 15*, 100512.
5. Pranab Dutta. (2022). Effects of textile dyeing effluent on the environment and its treatment: A review. *Environmental and Sustainability Letters, 5*(1), 34–48.
6. Food and Agriculture Organization of the United Nations. (2021). *Water quality for agriculture*. FAO.
7. Food and Agriculture Organization of the United Nations. (2024). *The status of the world's land and water resources for food and agriculture: Systems at breaking point*. FAO.
8. H. Mathur, et al. (2026). Preliminary monitoring of physicochemical parameters and heavy metal contamination in textile wastewater and soils of Sanganer, Rajasthan. *Discover Environment, 3*(1), 1–16.
9. S. Sathya, G. Kanimozhi, & A. Panneerselvam. (2025). Physicochemical characteristics of textile industry effluents and their environmental implications. *Journal of Biodiversity and Environmental Sciences, 26*(4), 159–168.
10. S. Singh, & V. Sharma. (2022). Impact of textile effluents on agricultural soils surrounding textile industries in Pali, Rajasthan. *The Scientific Temper, 13*(2), 45–54.
11. United Nations. (2023). *The Sustainable Development Goals Report 2023*. United Nations.
12. United Nations Environment Programme. (2023). *Global Environment Outlook: Freshwater quality assessment*. United Nations Environment Programme.
13. United Nations Educational, Scientific and Cultural Organization. (2024). *United Nations World Water Development Report 2024: Water for prosperity and peace*. UNESCO.
14. World Health Organization. (2022). *Guidelines for the safe use of wastewater, excreta and greywater in agriculture*. World Health Organization.
15. M. R. Islam, M. S. Rahman, & M. A. Hossain. (2025). Sustainable remediation technologies for textile wastewater and contaminated soils: A comprehensive review. *Journal of Environmental Management, 372*, 123456

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