



A Review of Textile Industry Pollution in Rajasthan: Status and Environmental Implications

Saumya Gupta¹, Ritu Singh Rajput^{2*}

¹Scholar at Department of Agriculture and Veterinary Science, Jayoti Vidyapeeth Women's University,
Email: saumyagupta985@gmail.com

^{2*}Assistant professor at the Faculty of Agriculture and Veterinary Science, Jayoti Vidyapeeth Women's University.

***Corresponding Author:** Ritu Singh Rajput

*Email: ritusingh71213@gmail.com

Abstract

The study examines the different types of pollution such as water, air, and land pollution, caused by the textile industry. This paper focuses on the pollution caused by the textile industry in Rajasthan, a state in India with a significant presence of textile manufacturing units. The paper also discusses the status of textile industry as well as the regulations and policies taken by the government to control pollution, Health risks and improve the situation in Rajasthan. To address these challenges, sustainable practices and technologies are crucial. Pollution can be considerably reduced by implementing cleaner industrial methods, wastewater treatment procedures, and waste management systems. Sustainable and ethical textile production can be aided by the use of eco-friendly dyes and chemicals, water recycling systems, bioremediation with the help of microorganisms, plants, algae and energy-saving technology. This is the need of industrialists and the general public to understand the severity of the pollution problem and take appropriate measures to address it.

Keywords: Textile industry, Pollution, Government policies

Introduction

The textile industry is one of the biggest and most significant industries worldwide, making a substantial contribution to the economic development of various countries. It covers a broad range of tasks, including the creation of natural and synthetic fibers, yarns, fabrics, and clothing as well as the production of household textiles and commercial textiles.

In India, The textile industry is one of the largest industries and it is also a major source of pollution. Millions of people are employed by it, and a sizable amount of the nation's exports come from it, making it a substantial contribution to the economy of the nation. After China, India is the world's second-largest manufacturer of textiles and garments.

The pollution caused by the textile industry has detrimental effects on the environment and local communities health. There are various health issues faced by humans due to textile industry pollution such as respiratory problems, cancer, skin irritation, eye irritation, neurological disorders, etc. For procedures like dyeing and finishing, the textile industry utilizes a lot of water, which is then dumped into water bodies without proper treatment (Khan and Malik, 2014). During the manufacturing processes in the textile industry, large amounts of pollutants are released into the air also. As a result, hazardous chemicals and dyes are released, which cause pollution of water, degrade aquatic life, air pollution and the generation of harmful solid waste (Dadhich et al., 2018). To reduce pollution from the textile sector, the Indian government has made various number of laws and rules to control pollution.

Textile industry in Rajasthan

In Rajasthan the textile industry is one of the biggest and most significant industries worldwide, contributing to economic development. Rajasthan has a rich tradition of textile manufacturing and is known for its handloom and handicraft products. Rajasthan is known for its traditional, colorful art. The block prints, dye prints, Gota patti work, Zari embroidery, Bagru and Sanganer prints, are major export products from Rajasthan. In Rajasthan's Barmer and Jaisalmer regions mukke-ka-kaam embroidery is very famous which is Gold and silver threads work (Singh, 2022). The textile clusters in Rajasthan contribute to the state's economy and provide employment to a large number of people. Jaipur is one of the major textile clusters in Rajasthan, known for its hand block printing, lehriya, bandhani and embroidery work. The city has a rich history of textile production and today it is home to several large textile manufacturers and exporters. Bhilwara and Kishangarh serve as the state's primary power loom hubs and are particularly known for producing viscose elastane fabrics (Satpathy and Gupta, 2023). Another significant textile cluster in Rajasthan is the Pali textile industry which is recognized for its printing and dyeing activities, particularly in the areas of bandhani (tie and dye). Pali is home to a multitude of small and medium-sized units involved in the printing, dyeing, and finishing of fabrics. The cluster's expertise lies in creating vibrant and intricate designs through traditional printing and dyeing techniques. In the town of Balotra, textile printing takes center stage, especially in the domain of block printing. The cluster in Balotra comprises numerous small and medium-sized units engaged in printing, dyeing, and finishing activities. These units employ block printing techniques to create unique and visually appealing patterns on fabrics. Jodhpur City in Rajasthan has a large number of

units engaged in textile processing activities such as dyeing, printing, and finishing. Ajmer on the other hand stands as a major hub for woollen textiles which produces warm and cozy fabrics. Rajasthan's textile sector is a stunning example of how ancient artistry and contemporary production methods can coexist together. The textile industry in Rajasthan goes beyond the production of clothes and extends its creativity to crafting artistic items using textiles. This includes the creation of unique products like jootis (traditional footwear), banjara bags and various home decor items. These artistic pieces are made by skillfully utilizing textiles and incorporating traditional techniques, resulting in visually appealing and reflecting the vibrant culture and heritage of the region.

Assessing Present Condition of textile industry in Rajasthan

The current status of the textile industry in Rajasthan is described by the positive and negative impacts of the textile industries.

A. Positive Impacts of Textile Industry

- Abundant availability of raw materials (cotton, wool, silk, etc.)
- Skilled workforce and traditional craftsmanship
- Favorable geographical location and infrastructure
- Growing domestic and international demand for textiles
- Development of textile parks
- Diversified product production in style, pattern and colors.

B. Negative Impact of Textile Industry

- unorganized sector
- Pollution and chemical usage
- Low productivity and efficiency
- High competition from other Indian states and countries
- Limited access to capital, technology, and innovation
- Not following environmental and social standards

C. Opportunities

- Growing domestic and international demand for textiles
- Shift towards sustainable and eco-friendly production
- Adoption of new technologies and automation
- Development of textile parks and clusters

D. Threats

- Intense competition from other Indian states and countries
- Fluctuations in raw material prices and exchange rates
- Changing consumer preferences and trends

Environment Pollution by textile industry

The textile industry generates a large amount of waste and pollution throughout its production process, from dyeing to the finishing process. Some of the major sources of pollution caused by the textile industry include:

1) Water pollution

The textile industry is one of the major contributors to water pollution globally. Textile manufacturing involves several processes which require large quantities of water.

The discharge of untreated or inadequately treated textile effluents into nearby water bodies leads to serious environmental and health consequences. The pollutants in the wastewater can harm aquatic life and disrupt the ecosystem balance. Effluent from industries exceeds the permissible limits set by regulatory bodies for various pollutants, such as pH, biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), and heavy metals (Tüfekçi *et al.*, 2013).

2) Air pollution

Textile industries release harmful chemicals, particles, or biological materials into the air that can cause harm to humans by causing respiratory and heart diseases, other living organisms, and the environment which ultimately leads to air pollution (Sivaram *et al.* 2019). During the various textile industrial manufacturing processes mist, exhaust gases, dust, lint produces into the air. A large amount of energy is also needed to run production processes such as diesel generators in industries that produce harmful gases as well as noise. The production of harmful gases and particulate matter in the air contributes to global warming.

3) Hazardous waste pollution

The commonly use dyes such as azo dyes in the textile industry, are known to be toxic and can cause cancer. Heavy metals such as chromium, lead, and cadmium are also commonly used in textile manufacturing and can be released into the environment during production processes (Khan *et al.*, 2023). The disposal of hazardous waste is a major challenge for the textile industry. Improper disposal of hazardous waste can lead to environmental contamination and pose a threat to human health. Some common disposal methods used by the textile industry, such as landfills and incineration, can also contribute to pollution.

4) Land pollution

The hazardous waste from the textile industries such as dyes, chemicals etc are either directly dumped on land or dumped into water bodies which can seep into the soil and contaminate the land. (Sarwar and khan, 2022). Over time, these contaminants may build up in the soil, degrading it reducing its fertility and making it unsuitable for agriculture.

Table 1: Effect on the health of humans due to textile industry

S.no.	Potential compounds	Risks	References
1	Formaldehyde	They are carcinogenic and may lead coughing, asthma like symptoms. It may also lead to skin rash, itching and redness.	(Aldag et al. 2017)
2	Azo Dyes	When in contact they biotransformed and form arnotic amines in body which are carcinogenic and can cause skin irritation and organ failure in longer exposure.	(Chung. 2016)
3	Volatile Organic Compounds (VOCs)	Proper ventilation is needed while working with textile dyes that contain VOCs. Prolonged exposure to VOCs can irritate the respiratory system and may cause shortness of breath, respiratory irritation, hives etc.	(zhou et al. 2023)
4	Pesticides	pesticides used in textile production are associated with acute and chronic health issues lead to neurological disorders, reproductive problems, and cancer. Even it enter into the foodchain also indirectlt impact human health.	(Manickam and Vijay 2021).
5	Chlorinated Solvents	The chlorinated solvents including carbon tetrachloride and TCE which are human carcinogens. In pregnant women it may increases the risk of miscarriage and can cause developmental issues in child.	(McCarty 2010)
6	Nanoparticles	The laborers in the textile industries are more prone to health risks because of majority of exposure. It affects the skin respiratory tract , spleen, kidney and liver.	(Saleem and zaidi 2020)
7	Phthalates	They are use to increase the flexibility, and softness of materials in synthetic fibers in textile industry. They affect the hormonal system and reproduction system in humans.	(Wang and Qian 2021)
8	BPA and BTH	BPA (Bisphenol A), BTH (Bis(2-ethylhexyl) terephthalate) are associated with potential adverse effect on nervous system, fertility issues, obesity, diabetes etc.	(He et al. 2016)

Government Rules and Policies to control textile industry pollution

The enforcement and control of pollution in Rajasthan's textile industry is the responsibility of the Rajasthan Pollution Control Board (RPCB). The Air (Prevention and Control of Pollution) Act of 1981 and the Water (Prevention and Control of Pollution) Act of 1974 were both put into effect by the Rajasthan Pollution Control Board (RPCB) to regulate the discharge of pollutants from textile industry. To treat the effluent produced during by the textile production process, RPCB guidelines needed to be followed strictly by the textile Industries. In 2016, World Environment Day was celebrated in which chief guest Smt. Vasundhara Raje is invited who launched 'Drishti' app for monitoring pollution levels in industrial regions (Khatri *et al.*, 2017).

The State Government of Rajasthan has implemented the Rajasthan State Industrial Policy in 2019 which aims to promote environmentally friendly industrial growth. The incentives were also distributed to textile industries which are using eco-friendly pollution-reduction techniques. The National Green Tribunal (NGT) which is a specialized court, handles cases in which industries that do not follows environmental laws and regulations properly may have to deal with fines and punishments (Behuria, 2020).

Measures to control Pollution

In order to prevent contamination, the waste generated by the textile industries must be properly controlled. One of the most efficient methods of waste management is recycling, reusing, and reducing waste. Textile industries can use natural and low-impact dyes instead of chemical dyes to reduce the amount of toxic chemicals released into the environment (Agarwal and Sonia 2021). Reduced water usage can be achieved by implementing water conservation techniques like rainwater collecting, regular wastewater treatment using large digesters, reuse of treated wastewater, and adoption of water production methods (Kumar and Goyal 2020). For Organic waste management, vermicomposting can be done.

Bioremediation technique by the use of hyperaccumulator plants, microorganisms and algae which is one of the cost-efficient techniques can be a good choice to control pollution from industries.

Conclusion

The textile industry is one of the biggest producers of hazardous waste, as well as pollution of the air, land and water. Rajasthan, being one of the major textile-producing states in India, has a significant impact on the environment. Due to extended exposure to dangerous chemicals and hazardous working conditions, textile industry employees are especially vulnerable. Chemicals used in textile production have been connected to neurological diseases, skin irritation, respiratory issues, and even long-term health issues including cancer. Communities that are close to textile manufacturers have a high risk of suffering from the negative health impacts of pollution. Some of the possible solutions such as adopting cleaner production techniques, promoting the use of eco-friendly materials, putting wastewater treatment plants into place, and creating a suitable waste disposal system are all necessary to lessen pollution caused by Rajasthan's textile industry. Overall, it is necessary to take a collaborative approach between the government, industry, and civil society to tackle the issue of pollution from the textile industry in Rajasthan.

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