

Shades of Concern: Tackling Water Pollution from Textile Dyes

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WHAT IS TEXTILE WASTE ?



Textile dye is a substance used to color fibers, yarns, fabrics, and other textile materials. It's an integral part of the textile industry, allowing manufacturers to create a wide range of colors and patterns in textiles. Textile dyes can be derived from natural sources such as plants, animals, and minerals, or they can be synthetic, produced through chemical processes.

TEXTILE DYEING - THE 2nd LARGEST POLLUTER OF WATER GLOBALLY

Dyes are common in industries such as textiles, cosmetics, food processing, papermaking and plastics. People use tones of this in order to color their clothing, eye shadows etc. During manufacturing, about a tenth of all dye products end up in the waste stream. Most of these dyes escape conventional wastewater – treatment processes and remain in the environment, often reaching lakes or rivers. It is also effects and animals that live there. Even just a little added color can block sunlight and prevent photosynthesis, which disrupts the entire aquatic ecosystem.



One of the most alarming issues takes place during the process of dyeing the fabric. Not only does this consume large quantities of water, but the textile dyeing process is also the world's second-largest polluter of water. Every year, 1.3 trillion gallons of water are used by textile industries, as a way of dyeing garments. That amount of water is enough to fill 2 million Olympic-sized swimming pools. The biggest amount of this water is filled with dyes and chemicals that can cause environmental problems, but still it flows untreated into rivers and streams.

THE TOXICITY OF TEXTILE DYES

Some textile dyes can indeed be toxic, particularly certain synthetic dyes that contain chemicals harmful to human health and the environment. These toxic dyes may contain heavy metals, such as chromium, lead, and cadmium, as well as other hazardous substances like aromatic amines, formaldehyde, and volatile organic compounds (VOCs). Exposure to these chemicals can pose risks to textile workers during the manufacturing process, as well as to consumers who come into contact with dyed textiles.

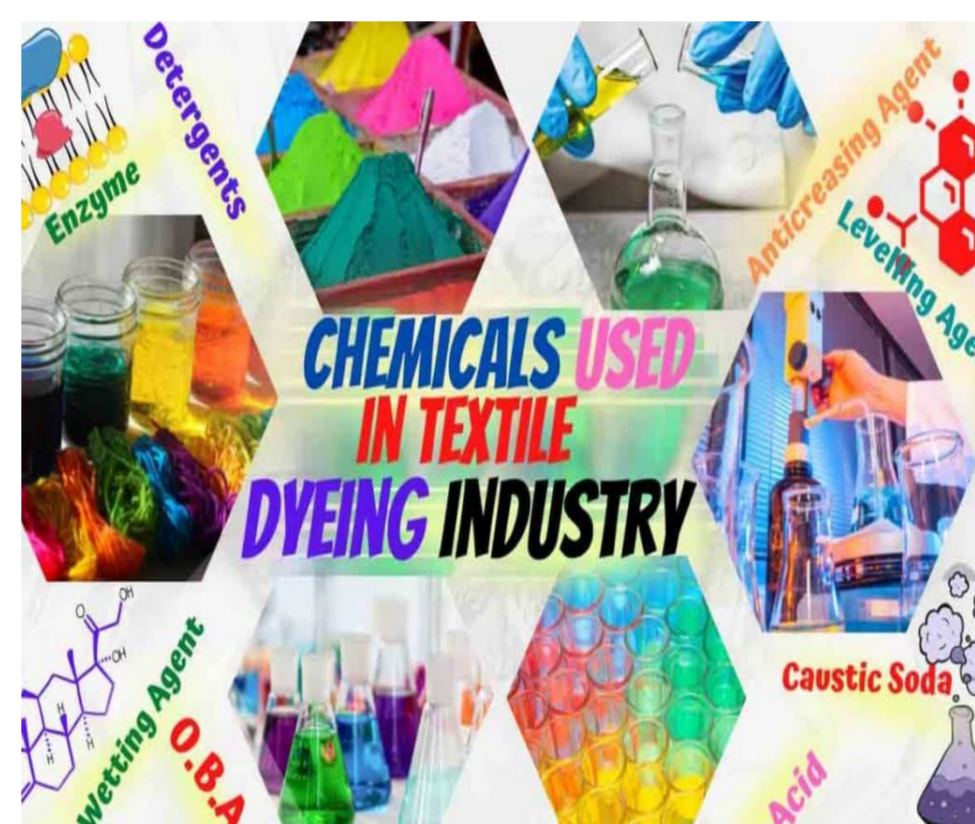
A BRIEF HISTORY OF TEXTILE DYEING

Historically, colour has been used in clothing to represent status or socio-economic position. The brighter and more brilliant colours like reds were often reserved for the elite, while poorer populations wore plain, dark colours. One notable example of this is in Japan, where the still-popular indigo dye found its origins. Ancient Greek, Roman and neighbouring civilisations used a range of plant and animal dyes to create coloured textiles. Plant dyes included crocus sativus (ochres), madder, woad, weld (yellow), walnut hulls, oak gall (brown and black), orchil lichen (pink/purple), alchanet (red), and saffron crocus (yellow).



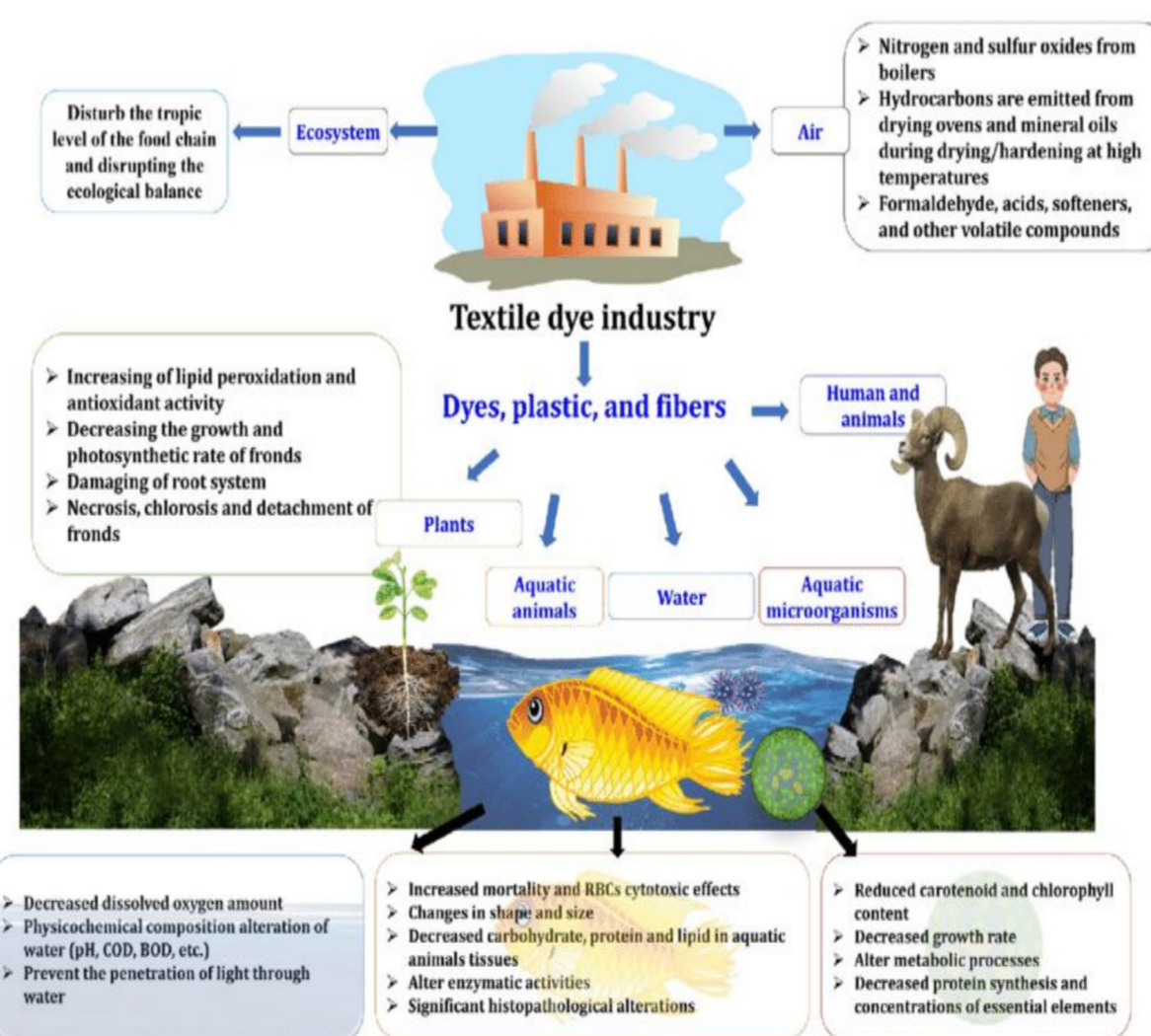
TO DYE OR TO DIE?

- Water contamination can result from clothing colors that are thrown away incorrectly or spilled into bodies of water. Aquatic ecosystems may be negatively impacted by the dyes' mixture of artificial and chemical components. These colors have the potential to pollute drinking water supplies, destroy the delicate balance of aquatic life, and endanger human health when they get into streams.
- In addition, several dye chemicals have the potential to be poisonous to aquatic life forms, including fish and invertebrates. Pollution can cause food chains to break, biodiversity to drop, and vulnerable species to become extinct.
- The actual dying phase requires a lot of water (200 tonnes for each tonne of textiles, to give you an idea)
- It's usually dumped directly into waterways, especially in developing countries. Many Asian rivers are *literally* turning black!
- Every year, 1.3 trillion gallons of water are used by textile industries, as a way of dyeing garments. That amount of water is enough to fill 2 million Olympic-sized swimming pools. The biggest amount of this water is filled with dyes and chemicals that can cause environmental problems, but still it flows untreated into rivers and streams.
- Once the hazardous dyes enter the ecosystem of a river, lakes, or the ocean, they don't break down. Instead, they're spread around the globe via the water cycle. That's why, even though we outsource textile dyeing to developing countries, where fashion pollution is created, the aftermath of this impact ecosystems around the globe.
- Over 70% of rivers in China are polluted, endangering local ecosystem, and the human population. In these areas, where fashion pollution from textile dyeing is released, even groundwaters are contaminated.



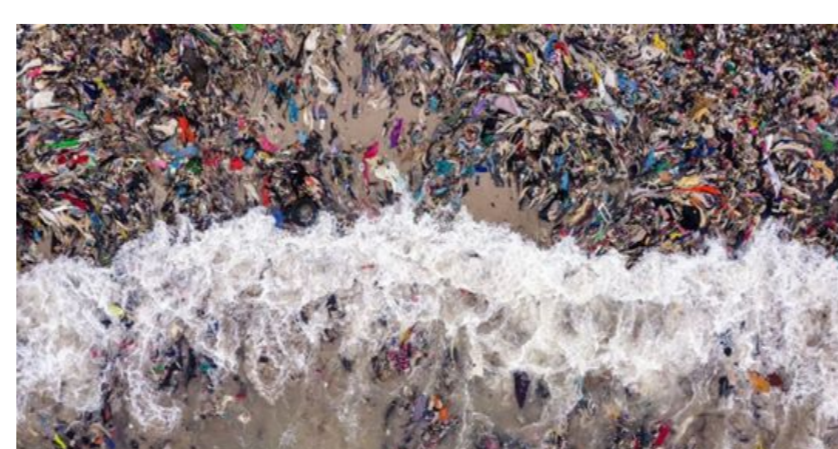
FACTS ON TEXTILE DYEING

- 20% of all industrial water pollution is caused by fabric dyes and treatments.
- It is estimated that 10,000 different dyes are used industrially.
- 8,000 synthetic chemicals are used to bleach, treat, and brighten our clothes.
- Azo dyes, which account for 60-70% of all dyes in the industry – are known carcinogens.
- Mills can use up to 200 tons of water per ton of dyed fabric; which in turn, only produces about 1400 pieces of clothing.
- Mills discharge millions of gallons of effluent as hazardous toxic waste; full of color and organic chemicals from dyeing and finishing salts.
- The wastewater from textile plants is classified as *the most polluting of all the industrial sectors*; considering the volume generated, as well as the effluent composition.
- During the dyeing process, it is estimated that the loss of colorants that end up in the environment ranges from 10-50%, depending on the color and chemicals used.
- Phthalates and NPEs are among the chemicals known as endocrine disruptors, which are used often and in vast quantities in textile processing.
- Synthetic dyes have endocrine disruptors. Endocrine disruptors are chemicals that can interfere with endocrine or hormone systems at certain doses.



ARE DYES ALWAYS HARMFUL?

Clothing dyes aren't always harmful. Depending on *how* they're created, that's when clothing dyes can become toxic and harmful. However, 90% of our clothes are dyed synthetically, using dyes created in labs through chemical processes.



SOLUTION TO DYE POLLUTION

There are a number of ways to reduce water pollution in the textile dyeing industry. Some of these methods include:

- **Natural dyeing:** This involves using dyes derived from natural sources such as plants, vegetables, fruits, and minerals. Common natural dye sources include indigo, turmeric, onion skins, and madder root. Natural dyeing processes are generally safer for both the environment and human health, although they may require additional steps or mordants (substances used to fix the dye) to achieve color fastness.
- **Low-impact dyes:** Low-impact dyes are synthetic dyes that have been specially formulated to minimize their environmental impact. They typically require less water and energy to apply, and they produce less waste compared to traditional synthetic dyes. Low-impact dyes are also designed to be free from toxic heavy metals and other harmful chemicals, making them safer for both workers and consumers.
- **Eco-friendly dyeing processes:** Some textile manufacturers employ eco-friendly dyeing processes that prioritize sustainability and minimize environmental harm. These processes may include techniques such as waterless dyeing, which uses minimal or no water, and dyeing with non-toxic chemicals and natural additives.
- **Digital printing:** Digital printing is a relatively modern technique that involves directly printing dyes onto fabric using inkjet technology. This process can be more precise and efficient compared to traditional dyeing methods, and it typically requires fewer chemicals and less water. Digital printing also allows for greater design flexibility and customization.
- **Sustainable dyeing technologies:** Innovations in dyeing technologies continue to emerge, with a focus on sustainability and reducing environmental impact. For example, some companies are developing dyeing processes that utilize renewable energy sources, bio-based dyes made from agricultural waste, or closed-loop systems that recirculate and reuse water and dye chemicals.



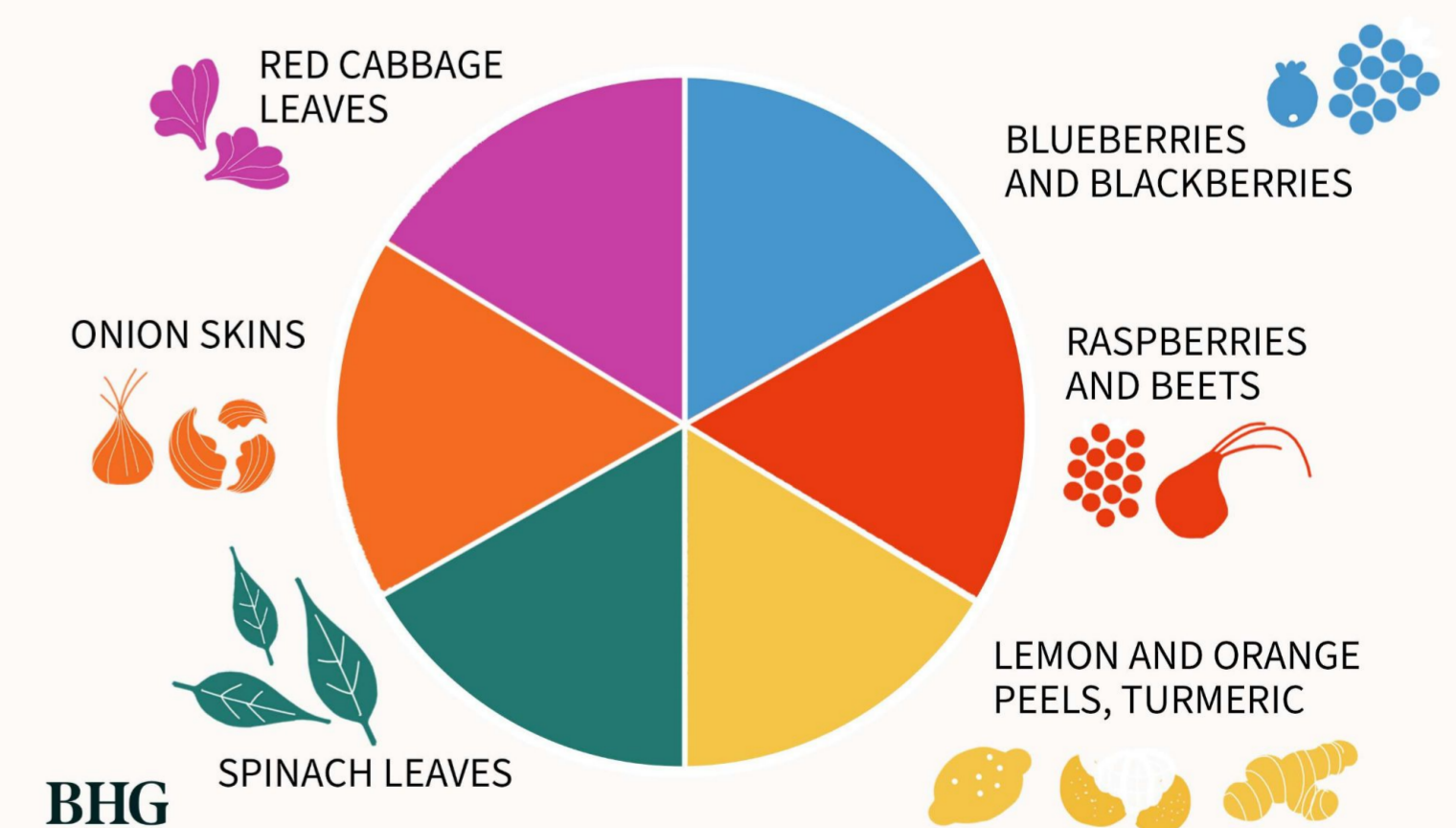
- **Using less water:** This can be done by improving the efficiency of the dyeing process, using water-saving technologies, and recycling water.
- **Using less harmful chemicals:** There are a number of dyes and chemicals that are less harmful to the environment than the traditional dyes and chemicals used in the textile industry. These dyes and chemicals can be used to achieve the same results, but they have a lower environmental impact.
- **Treating wastewater:** The wastewater from dyeing plants can be treated to remove the pollutants before it is discharged into the environment. This can be done by using physical, chemical, or biological treatment methods.
- **Implementing best practices for wastewater management:** Adopting best practices for wastewater management, such as proper containment, treatment, and disposal of wastewater, can help prevent dye chemicals from contaminating water bodies. This may include installing wastewater collection and treatment systems, implementing spill prevention measures, and complying with regulatory requirements for wastewater discharge.

Researchers in Khalifa University of Abu Dhabi created a nanomaterial that they believe that can clean up the industrial waters from dyes and other toxic chemicals. That material is built from tiny sand-like grains that collect that dyes and the chemicals on their surfaces and their pores.

SUMMARISING

With the rapid development of textile industry, the production of dye waste-water has increased year by year. The dyeing process is a major source of water pollution because the wastewater from dyeing plants can contain a variety of pollutants, including dyes, chemicals, and heavy metals which can harm aquatic life and ecosystems, and pose a health risk to humans. Supporting the use of natural colors derived from plants and other organic sources, supporting eco-friendly dyeing techniques, and enforcing laws on dye usage and disposal are some of the steps taken to reduce the water pollution caused by garment dyes.

NATURAL FABRIC DYE GUIDE



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