University of Nottingham
Institute for Policy and Engagement

Policy Briefs:
The unnatural natural: Environmental impacts of fashion's plastic alternatives

Executive Summary

Plastic pollution poses multiple environmental threats. Plastic litter can entangle animals, can transport harmful chemicals and microorganisms through environments, and can be ingested by organisms as large as whales and as small as zooplankton. These problems have generated far-reaching environmental concern, interest, and action.

This policy brief will concentrate on plastic-fibred clothing as a key source of plastic pollution. During a garment's lifecycle, potentially harmful plastic fibres are released into the environment. Some consumers and manufacturers are now favouring materials such as cotton and wool in order to minimise the plastic footprint of their fashion. However, University of Nottingham research suggests that such behavioural changes may not offer the environmental benefits that have previously been assumed.

Context

Plastic textiles, such as those made from polyester, nylon, and acrylic (Box 1) release fibres throughout their lifecycles. Fibres under 5 mm are defined as microplastics, a diverse group of pollutants that are global in their distribution and complex in their environmental impact. The release of microplastic fibres to aquatic environments is often attributed to wastewater treatment infrastructure.

In an effort to minimise microplastic fibre pollution, some manufacturers and individuals are favouring non-plastic clothing, such as that made from natural (cotton, wool) and semisynthetic (viscose) fibres (Box 1). These are sometimes marketed as 'green' alternatives to plastic clothing. However, though technically biodegradable, the processing they undergo makes natural textile fibres inherently unnatural, and the potential impacts of natural fibres in the environment are not well understood.

A growing body of environmental literature, including research from the University of Nottingham, is reporting natural textile fibres in similar or greater abundances than their microplastic analogues[1-4]. Natural fibres have also been found to persist in environments for centuries[5,6]. There is therefore a pressing need for further research into the environmental prevalence and impacts of natural textile fibres.

Main recommendations

In order to understand the environmental impacts of textile fibres, this policy brief makes the following recommendations to industry, legislators, and research funders:

- Definitions of microfibers and synthetic fibres, including size and materials, should be clarified and standardised.
- Research should be undertaken to quantify the abundance and persistence of textile fibres of all types, not just microplastic, in the environment.
- Research assessing the relative environmental and ecological impacts of all, not just microplastic, textile fibres in different environments is required.
- Comparative lifecycle assessments should be conducted that encompass all major textile fibre types from fibre production to the end of their life.

Key findings

The majority (>90%) of textile fibres identified from 123 river and 93 atmospheric samples collected over the course of one year were natural[3]. However, though abundant in the environment, the environmental consequences of natural textile fibres are not known. Scientists, industry, and legislators cannot presume that natural fibres do not present an environmental threat. Their prevalence in the environment, highlighted by this research and consistent with similar work in this emerging field[1,2,4], suggests that non-plastic clothing should not be promoted as a green plastic alternative without further research.

Efforts to move away from plastic-fibred garments also overlook additional, more pressing, consequences of natural fibre production and the rapid turnaround of cheap fashion collections, known as 'fast fashion'. These are both environmental (e.g. land use, use of pesticides, water abstraction, chemical pollution) and social (e.g. exploitation, chemical exposure).

The garment industry is the world's third largest manufacturing industry[7]. Misinformation relating to the environmental credentials of textile materials therefore has far-reaching consequences in this sector.

Methodology

A 12 month campaign of freshwater and atmospheric sampling conducted by the University of Nottingham School of Geography and Faculty of Engineering quantified natural textile fibres in much greater abundances than microplastic fibres[3].

The team also engaged with an interdisciplinary network of stakeholders with representatives from academia, industry, governmental and non-governmental organisations, and advisory groups to identify knowledge gaps that will better inform decision makers and consumer behaviour. The recommendations presented here are informed by this engagement.

Contact the researchers

Dr Thomas Stanton
Research Associate
School of Geography and Food Water Waste Research Group
thomas.stanton2@nottingham.ac.uk

Dr Matthew Johnson
Associate Professor
School of Geography
m.johnson@nottingham.ac.uk

Dr Rachel Louise Gomes
Professor of Water & Resource Processing
Food Water Waste Research Group, Faculty of Engineering
rachel.gomes@nottingham.ac.uk

Calling for new perspectives in plastic pollution discourses

The prevalence of plastic in the environment is rightly a considerable public, political, and academic concern. However, the dominance of anti-plastic discourses in environmental research and communication have contributed to a culture of plastic anxiety. Without questioning their impacts, the associated shifts in consumption to favour plastic alternatives risk compromising present and future environmental and social wellbeing at scales much greater than the environmental fate of the plastic they replace.

Plastic pollution is just one of many, often less salient, anthropogenic pressures in the environments that it pollutes. The dominant concern for plastic pollution risks detracting attention from these different, but no less important, environmental problems.

Box 1: A brief summary of textile fibres

The majority of textile fibres fall under one of three categories: natural, semisynthetic, and synthetic.

Natural fibres are derived from plants (e.g. cotton) or animals (e.g. wool).

Semisynthetic fibres are also derived from plant (e.g. rayon) or animal (e.g. casein) sources. Their source materials undergo transformation processes before being shaped into fibres.

Synthetic fibres are derived from fossil fuels, and include polyester, polyamide, and acrylic.

Natural and semisynthetic textile fibres can biodegrade. However, the biodegradation of these fibres in the environment is influenced by both the processing they undergo to be suitable for the textile industry, and the environment in which they end up.

Cited literature

1. Compa, M. et al. 2018. Marine Pollution Bulletin, 128, 89-96.
2. Halstead, J.E., et al. 2018. Environmental Pollution, 234, 552-561.
3. Stanton, T. et al. 2019. Science of The Total Environment, 666, 377-389.
4. Le Guen, C., et al. 2020. Environment International, 134, 105303.
5. Chen, R. and Jakes, K.A., 2001. Journal of the American Institute for conservation, 40(2), 91-103.
6. Müller, M. et al. 2006. Applied Physics A, 83(2), pp.183-188.
7. Environmental Audit Committee, 2019. Fixing fashion: Clothing consumption and sustainability. House of Commons, London