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Wool in Marine Environments

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A Global Challenge

Microplastic pollution has emerged as one of the most critical global challenges of our times. It is estimated that 12.2 million tonnes of plastic enter the global marine environment each year. Of this, 3.2 million tonnes are estimated to be primary microplastics, i.e. particles less than 5mm in size released directly into the environment.

Major sources of primary microplastics are road abrasion of synthetic tyres and the shedding of fibres during washing of textiles such as nylon, acrylic and polyester^[1]. Microplastic fibres, or microfibrils, are shed from clothing during machine washing and enter waterways in laundry wastewater streams. These fibres can accumulate on the ocean floor and may be ingested by aquatic organisms and enter the food chain. The full impacts on marine ecosystems are not yet known, but the risk to the environment and potentially to human health through drinking water and eating seafood are a significant concern.

A Natural Fibre Solution

One proposed strategy against the problem is to increase the use of natural fibres in apparel. To date, scientific reporting on microfibrils has not included data on microfibrils of natural origin, and the textile industry is seeking evidence that fibres such as wool and cotton do not similarly contribute to pollution of marine environments.

Until research results become available, two independent sources not specifically related to research on microfibrils provide some confidence that fibres shed during washing of wool clothing are unlikely to contribute to persistent pollution as do those from synthetic clothing:

- 1 Wool has been shown to be biodegradable in marine environments, in laboratory and on-site testing^[2]. In vitro experiments in New Zealand showed surface damage to wool fibres after 21 days incubation in sea water. Degradation of wool fibres in situ in Lyttleton Harbour was clear after three months, and at eight months bacteria that degrade protein had increased, the fibre surfaces were pitted, and the structure of wool fibres had deteriorated. Visual observations, microscopic studies and microbial analyses confirmed the action of the wool degrading bacteria. In contrast to terrestrial biodegradation, degradation of wool in the marine environment was not dominated by actinomycete and fungal components of the microflora but by marine bacteria.

2 A study supported by the US EPA Mote Marine Laboratory has reported 'decomposition rates' for a range of household and other items of marine debris^[3,4]. Decomposition was estimated as the time it takes for the item to be no longer visible. Times for cotton and wool garments were, respectively, less than 6 months and 1 to 5 years (Table 1). The result for wool socks is not inconsistent with the results above^[2] but it is not known to what extent the US results were influenced by the focus of the marine debris program on beach and shallow water observations^[3]. NOAA^[4] notes that for plastic items such as nylon fabric and disposable diapers the estimates are for the time it takes for these items to degrade to microplastic form, not to return to nature. Further, Plastics are different from the other materials that make up marine debris. Plastics do not biodegrade the way other materials do. Instead, they photodegrade.... this means that instead of being broken down naturally by other organisms, plastics are broken down into smaller and smaller pieces by the sun, wind and waves, but they never completely go away.

Table 1. Examples of the rate of decomposition of items of marine debris relevant to apparel and footwear.

MARINE DEBRIS	TIME TO 'DISAPPEAR'
Cotton shirt	2-5 months [2]
Wool sock	1-5 years [2]
Nylon fabric	30-40 years* [3]
Leather	50 years [3]
Rubber boot sole	50-80 years [3]
Disposable diaper	450 years* [3]

* Plastic items degrade to particles too small to be visible but remain as microplastic particles.

These two sources provide evidence that fibres of wool and cotton biodegrade in marine environments and do not contribute to persistent microfibre pollution.



“After 8 months in saltwater, bacteria that degrade protein had increased, the fibre surfaces were pitted and the structure of wool fibres had deteriorated”

About IWTO

With a world-wide membership encompassing the wool pipeline from sheep to shop, the International Wool Textile Organisation (IWTO) represents the interests of the global wool trade. By facilitating research and development and maintaining textile industry standards, IWTO ensures a sustainable future for wool. To learn more about IWTO and its activities, visit www.iwto.org.



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