

On a more abstract front, there has also been research recently from Nick Morley, Oakdene Hollins Ltd, which prepared the 2009 report to Defra, *Maximising Reuse and Recycling of UK Clothing and Textiles*, and Katie Ryder, University of Manchester, on the manufacture of paper from recycled textiles.

Clothing rags were a traditional source of cellulose for paper manufacture in the UK until they were displaced, relatively recently, by wood pulps. Today, paper from rags is once again under consideration as a possible product. In this case the motivator is the increasing volume – and decreasing cost – of clothing being purchased in the UK, leading to an increase in textiles that are being discarded either to reuse, to recycling or to waste.

According to the (unpublished) research paper, whilst markets for the sale of used clothing are currently buoyant, the markets for the lower grades of clothing not suitable for resale are generally mature or declining. "Combined with competition with superior virgin fibre substitutes, this leads to very low prices for these grades, typically below the cost of collection and sorting of the clothing – sometimes substantially so," the paper says. "Environmental and commercial interests are combining to identify new markets for these recycling grades. One market under consideration is paper, although current costings make conversion to conventional paper products unattractive unless significant value were added in some way."

In theory, textile fibres obtained from plants, such as cotton, hemp, flax and jute, are ideal materials for making paper. This is because they all contain cellulose, with cotton having the highest percentage. "Their hydrophilic nature enables excellent dispersion within a water medium. The water and fibre, when subjected to chemical and/or mechanical action, represent the pulp slurry. Cellulose fibres have the inherent ability to bond with adjacent cellulose fibres through hydrogen and oxygen atoms found on the fibre surface. The inter-fibre hydrogen bonds are what turn individual fibres into a sheet of paper. Such bonds form when the sheet is dried, and are one of the main contributors to the strength of the paper sheet." One to watch. ■

BOTTOMS UP

Textile, clothing and accessory designer Anne Prahll has been exploring new opportunities and challenges for sustainable working practices by treating pre and post consumer waste as a raw material. One of the key elements of the collection is the development of recycled swimwear flock, the creation of an aesthetically pleasing and innovative water resistant embellishment for bikinis and swimsuits.

According to Prahll, even though elastane is notoriously difficult to recycle, there is an increasing need for developing ideas on how to keep discarded swimwear out of landfill. Currently, re-use and recycling options for swimwear are limited, mainly due to issues with hygiene and material degradations.

In particular, this applies to swimsuits and bottoms as bikini tops can often be redistributed to developing countries to be re-used as bras. "Worn out swimwear, especially bottoms, can end up in landfill as it is difficult to reuse," Prahll says, adding that her experimentation with the deconstruction of swimwear materials into a 'flock like' texture produced interesting aesthetics and further potential for exploration.

"Shredding discarded swimwear into fibres, creating beautiful bikini flock gives old swimwear a second life as a print on a new piece which can be recycled again when worn out," she says. "This process can go on a continuous loop."

Prahll ensured that all of the bikinis used were made from 100% recycled nylon, with Unifi's Repreve selected as the key element for new the swimwear pieces. Interestingly, her findings also progressed into investigating the negative impact of dyeing on the environment. "I developed a no dye concept, utilising intricate layers of sublimation transfer printing to apply colour directly to the bare fabric, creating unusual aesthetics and cutting out altogether the need for a dyeing process," she explains. "Sublimation printing was chosen as it uses only the amount of dye necessary for the print and eliminates the use and pollution of water as in screen printing."

Importantly, Prahll believes that the design concept has the capability to be reproduced on a commercial scale. "I believe this concept has potential for industrial development despite current manufacturing issues with the disassembly of mixed fibre materials and further research has shown that recycled waste materials, even containing spandex or elastane can be converted into flock. The key will be to develop cost and energy effective methods for re-manufacturing which could lead to the development of closed loop product strategies for the future." ■



Image © Anne Prahll Caption: Recycled bikini flock