ECOS
SCIENCE FOR SUSTAINABILITY

www.ecosmagazine.com

Published: 2009

Waste feathers show fibre promise

Heather Forward

Scientists at CSIRO Materials and Science Engineering's (CMSE) laboratory at Belmont, Victoria, believe that feather keratin can be 'regenerated' into an environmentally sustainable, biodegradable fibre.

Credit: CSIRO Materials and Science Engineering

An estimated 5 million tonnes of chicken feathers are produced globally each year as a by-product of meat manufacture – giant United States chicken processor Pilgrim's Pride alone has the capacity to slaughter 45 million birds a week. But currently, the feathers are either disposed of in landfill or processed to make a low-grade animal feedstock.

Feathers are rich in keratin, a tough, waterproof chemical-protein, ideal for fibres. Provided waste feathers can be converted into durable fibre, it would feed directly into the textile chain.

'It's a fantastic, ready-made production pipeline,' lead Research Scientist Dr Andrew Poole says. 'If we can master making the right fibre from feathers, we simply join the feather production stream into the existing textile manufacturing process.'

Once produced, fibre can be processed on conventional textile equipment and use conventional dyes.

Currently, synthetic textiles use around 500 million barrels of oil per year to produce 38 million tonnes of textile fabric. Dr Poole's team wants to save diminishing oil resources by coming up with a sustainable alternative.

While much current research focuses on cellulosic fibres (derived from plants), the researchers considered that protein fibres generated from waste or by-product sources should be explored.

Work was done during the 1930s to 1950s on fibres from proteins such as soy or peanut, but these fibres, although soft with good drape, lacked strength when wet. This problem, together with the rise of oil-based synthetic fibres, caused production to stop in the late 1950s.

To make a protein fibre for today's market would require the wet-strength problem to be resolved.

'The scientists have to first work out how to break down the molecular bonds between feather protein strands without breaking down the strands themselves,' Dr Poole says.

That achieved, they have to straighten the separated proteins, align them, and re-bond them in a way that will form a fibre resistant to the wear and tear delivered to all textiles. This is where the challenge still lies for the team.

Dr Poole believes that contemporary nanoparticle and cross-linking[1] technology has the potential to eventually overcome this problem, allowing commercial production to resume, in response to growing consumer demand for eco-friendly products.

'As a way to improve fibre strength, we're making protein films first to build up knowledge on properties, and then we can go on from there,' says Dr Poole.

And with a plentiful supply of waste feathers and a textile industry already well-experienced in using keratin-based fibre, the commercial possibilities look promising.

'We hope to have more conversations with potential commercial partners shortly. There are already expressions of interest from American companies that want a way to better dispose of their vast supplies of feathers,' Dr Poole says.

The timing is good. Growth of the eco-friendly and organic markets reflects the increased interest and power of consumer demand for eco-products.

All elements of the supply chain are in place for fibre production: there is a guaranteed supply of non-food materials from centralised locations and these materials are inexpensive, abundant and consistent in quality.

It's adding up to another prime opportunity to divert a waste stream into useful, commercially viable, bio-based materials that replace petrochemical products.

More information:

Poole AJ, Church JS and Huson MG (2009) Environmentally sustainable fibers from regenerated protein. *Biomacromolecules* **10**, 1–8.

Contact:
Dr Andrew Poole, Andrew.Poole@csiro.au

[1] Cross-linking (organic chemistry) is the setting up of chemical links between the molecular chains of polymers.

From **ECOS** online http://www.ecosmagazine.com/?paper=EC149p9